

MARCHANT*



DECI•MAGIC*
(MODEL SKA)

SERVICE INSTRUCTION BOOK

(NEW EDITION)

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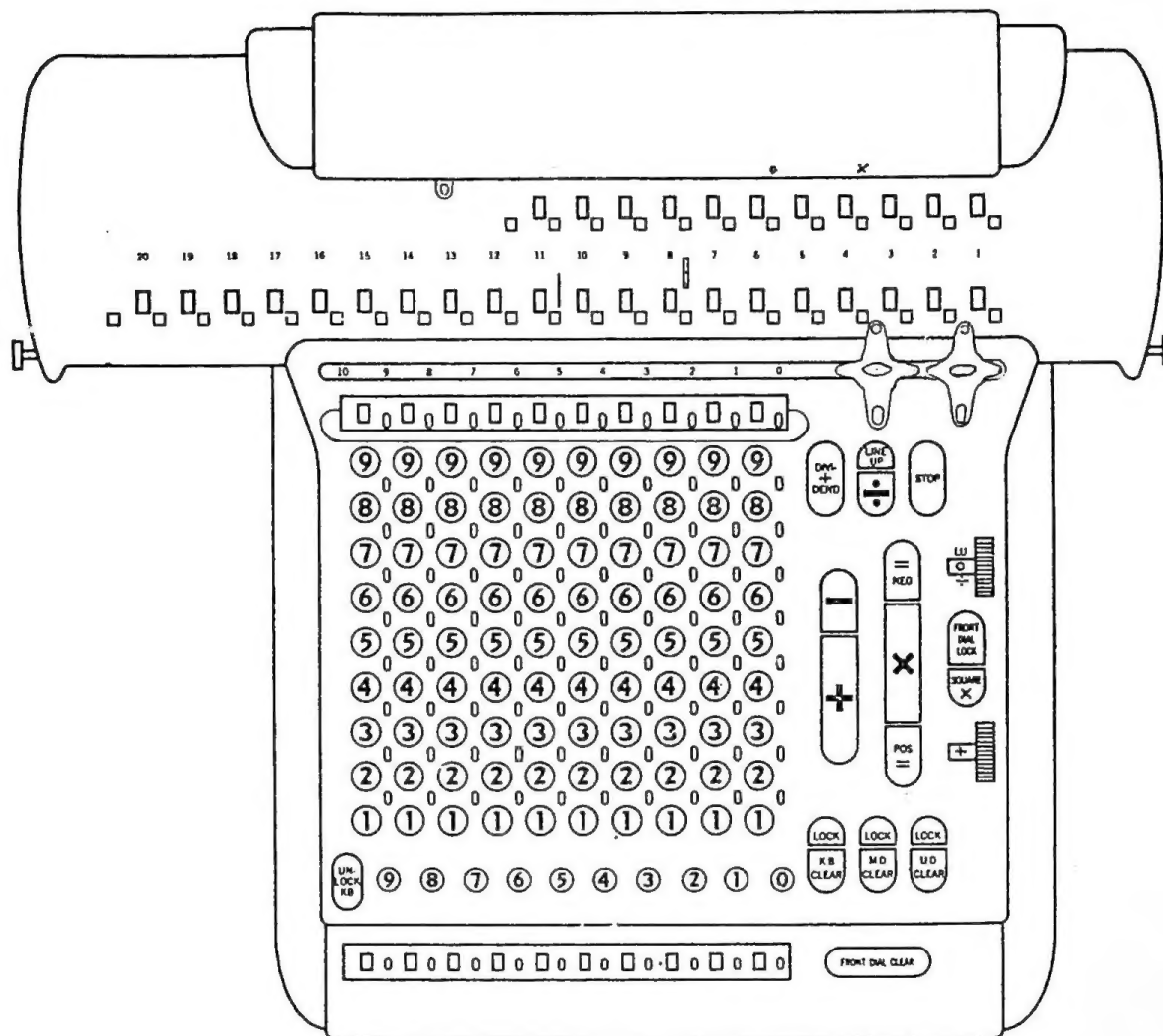
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TOP VIEW OF MODEL SKA

for

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INTRODUCTION

The Deci•Magic Model SKA is a fully automatic calculator with a capacity of 10 x 11 x 20 and a speed of 1,300 counts per minute and contains many new features and many revised features in the following functions: Decimals, Multiplication, Division, Addition, Subtraction, Carriage Control, Dial Clearance, Accumulation, Round-Off and Squaring. Many of the functions and unit assemblies are essentially the same as Model EFA. This Service Instruction Book has been prepared in several distinct sections, as indicated in the Index, for easier study and understanding. In each section such as Section I - DIVIDEND KEY, every attempt has been made to go into explicit detail utilizing illustrations wherever possible. In this manner of sectioning each important machine operational function, the problem of familiarization of the functions of the many new parts introduced in this model can be systematically studied and more easily grasped. This second edition comprises a complete revision which includes all improvements that have been made since the model went into production. The following condensed descriptions will serve to introduce the many new major operational features found in certain sections which are to be described and illustrated in detail later in the Service Instruction Book.


I. DIVIDEND KEY:

- A. Always clears Middle Dials.
- B. Opens Master Clutch.
- C. Clears Upper Dial unless Upper Dial Lock Key is depressed, or Counter Control Knob is set at "X-NE".
- D. Adds Keyboard entry into Middle Dial; selectively clears Keyboard unless Keyboard Lock Key is depressed.

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II. DIVISION AND LINE-UP KEYS:

- Division Control has been changed by elimination of the Main Operating Bar. Division Sensing is standard.
- A. Clears Upper Dials unless Upper Dial Lock Key is depressed, or unless Counter Control Knob is set at "X-NE" or "-".
 - B. Automatically controls counter to give positive count when Knob is at "+" or "X-NE", negative count if at "-". Automatically restores Knob to "X-NE" after "-".
 - C. If Line-Up Key is depressed, carriage tabs rightward the number of orders indicated by Line-Up Knob.
 - 1. When Line-Up Knob is set at "0", no shift, per above, occurs.
 - 2. When Line-Up Knob is set at , carriage shifts all the way to the right.
 - D. Initiates division.
 - E. Division terminates, and Keyboard and Middle Dial clearances occur selectively, unless respective Lock Keys are depressed.
 - F. Carriage returns to Decimal position.

III. ADD KEY:

Release of the Add Operating Lever allows the Setting Clutch Opening Lever to engage the Ratchet on Restore Drive Idler Gear to open the Setting Clutch for an Add Cycle. A Lock Key selectively controls Keyboard release.

- A. Initiates Add Cycle.
- B. Selectively clears Keyboard, unless Keyboard Lock Key is depressed.

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- C. Automatically controls counter to register as indicated on Knob.

IV. SUBTRACT KEY:

- A. Initiates Minus Cycle.
- B. Selectively clears Keyboard, unless Keyboard Lock Key is depressed.
- C. Automatically controls counter to register as indicated on Knob.

V. MULTIPLIER KEY:

Storage multiplier design. Constant multiplier may be stored and is visible in the Front Dials while machine may be used for other operations. The Multiplier Key Section and most of the older multiplier mechanism has been eliminated. Most of the new design is assembled into the lower front portion of the Selection Unit under the Keyboard, to the Front Frame and around the Center Frame.

- A. Enters Keyboard Setting into Multiplication Check Dials.
- B. Clears Keyboard selectively
- C. Shifts to leftmost digit order.

VI. EQUALS KEY:

- A. Clears Upper Dial and Middle Dial, if respective Lock Keys are not depressed.
- B. Initiates Multiplication.
- C. Carriage returns to Decimal position on multiplication termination.
- D. Clears Keyboard selectively, unless Keyboard Lock Key is depressed.

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VII. NEGATIVE EQUALS KEY:

- A. Clears Upper Dial and Middle Dial, if respective Lock Keys are not depressed.
- B. Initiates Negative Multiplication.
- C. Carriage returns to Decimal position on multiplication termination.
- D. Clears Keyboard selectively, unless Keyboard Lock Key is depressed.
- E. Controls counter to register as indicated on Knob.

VIII. SQUARE X-KEY:

Identical to Multiplier Key, except that it disables Keyboard Clearance that normally follows Multiplier Key depression.

IX. FRONT DIAL LOCK:

- A. Prevents clearance of multiplier at end of multiplication problem. May be depressed before, or during, depression of Multiplier Key, or anytime thereafter, prior to completion of multiplication problem.

X. FRONT DIAL CLEAR KEY:

- A. Clears Multiplier Dials, if previously locked in by Front Dial Lock Key and releases Front Dial Lock Key.
- B. If depressed during multiplication, Front Dial Lock Key is released and multiplier is cleared at end of multiplication problem.

XI. STOP KEY:

- A. Stops division, same as previous models.
- B. Stops multiplication on completion of current multiplier digit.
- C. If depressed after multiplier has been entered but before Equals Key has been depressed, Stop Key will clear out multiplier and return carriage to decimal position.

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XII. KEYBOARD CLEAR KEY:

- A. Clears Keyboard selectively.
- B. Releases Keyboard Lock Key.
- C. Allows entry to be locked into Keyboard, disabling all automatic Keyboard clearances.

XIII. KEYBOARD LOCK KEY:

- A. Prevents all automatic Keyboard clearance, except Keyboard clearance on Multiplier Key depression.

XIV. UNLOCK KEYBOARD KEY:

- A. Clears Keyboard entirely.

XV. MD AND UD CLEAR AND LOCK KEYS:

- A. MIDDLE DIAL CLEAR KEY
 - a. Clears Middle Dial.
 - b. Releases Middle Dial Lock Key.
- B. MIDDLE DIAL LOCK KEY
 - a. Prevents all automatic Middle Dial clearance, except that caused by depression of Dividend Key.
- C. UPPER DIAL CLEAR KEY
 - a. Clears Upper Dial.
 - b. Releases Upper Dial Lock Key.
- D. UPPER DIAL LOCK KEY
 - a. Prevents all automatic Upper Dial clearances, including Upper Dial clearance upon depression of Division Key.

XVI. COUNTER CONTROL KNOB:

The normal position of the Division Counter Control Lever is rearward in SKA, held there by spring tension. For positive count in subtraction, the Counter Return Lever is raised by the position-

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ing of the Reverse Setting Bar Assembly, which allows the Control Lever to remain rearward for a positive count, negative actuation.

- A. At "+" setting, it automatically gives plus count in addition, subtraction, division and plus or minus multiplication.
- B. At "-" setting, it automatically gives minus count in all of above and disables Upper Dial clearance upon depression of Division Key to allow subtraction of quotients.
- C. At "X-NE" setting, it prevents all counts except quotients and prevents all Upper Dial clearance except that of the Upper Dial Clear Key.

XVII. HALF-CENT LEVER:

When Half-Cent Operating Lever is positioned upward, it causes the Middle Dial adjacent to the left to register a "5" when the Middle Dials are cleared.

XVIII. SPLIT CLEAR KNOBS:

Same as at present.

XIX. DECIMAL KEYS:

Carriage will always shift to a depressed Decimal Key in all automatic tab operations, upon completion of any machine operation which has moved the carriage from its decimal set position, or upon depression of a Decimal Tab Key, (similar to the "Live Tab" used in model AB-10FA). If no Decimal Keys are depressed, the Carriage automatically moves to its rightmost position after completion of multiplication and division.

Carriage shifts are initiated through a Live Point on the inside Carriage Dip Lever as the Carriage rises. The Manual Shift Keys, Shift Rack, and Vertical Shaft are eliminated. Carriage

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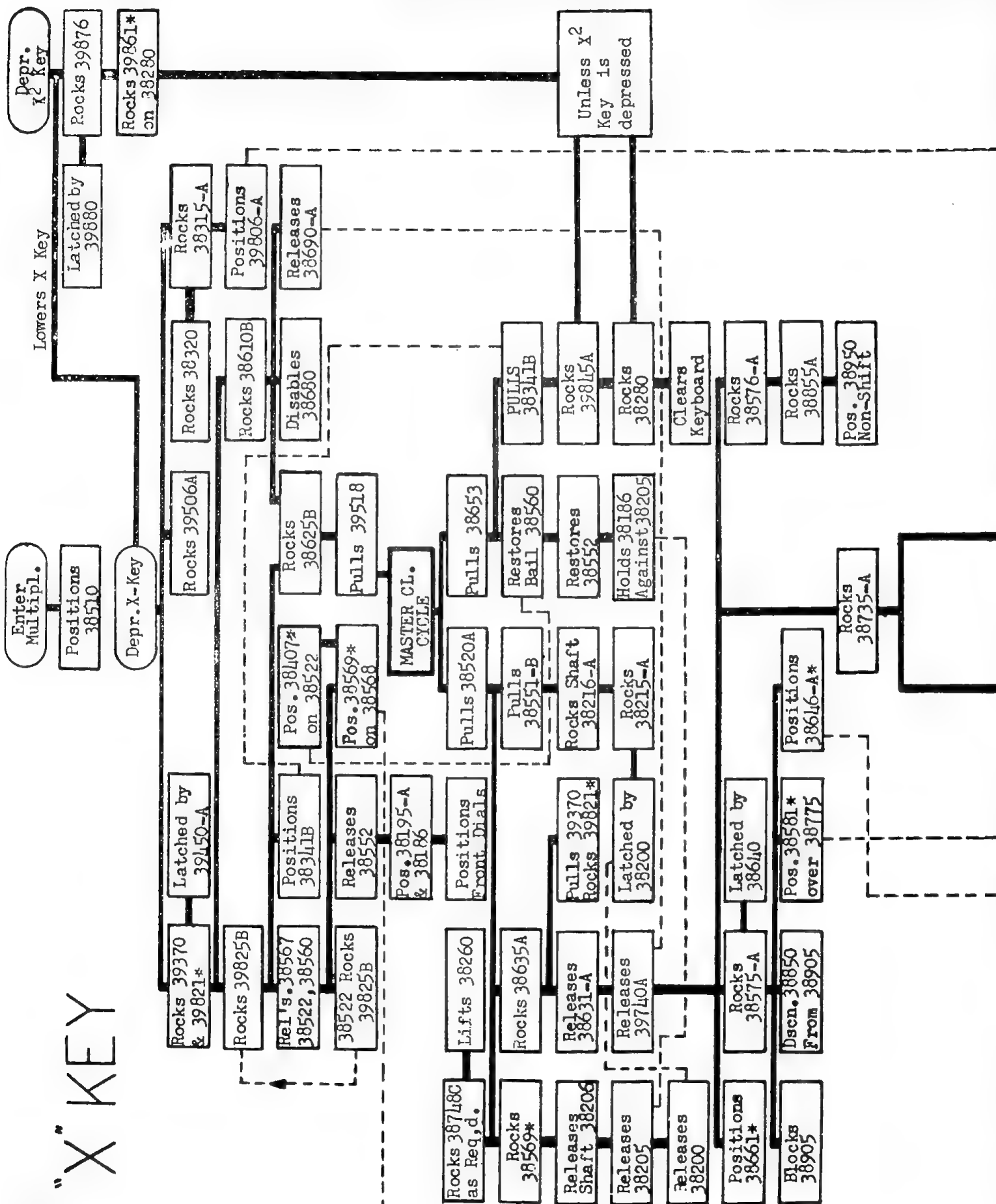
Drive is from the Shift Jack Shaft to a train of gears mounted to the Left Side Frame, through Carriage Drive Shaft to Carriage.

XX. INTERLOCKS:

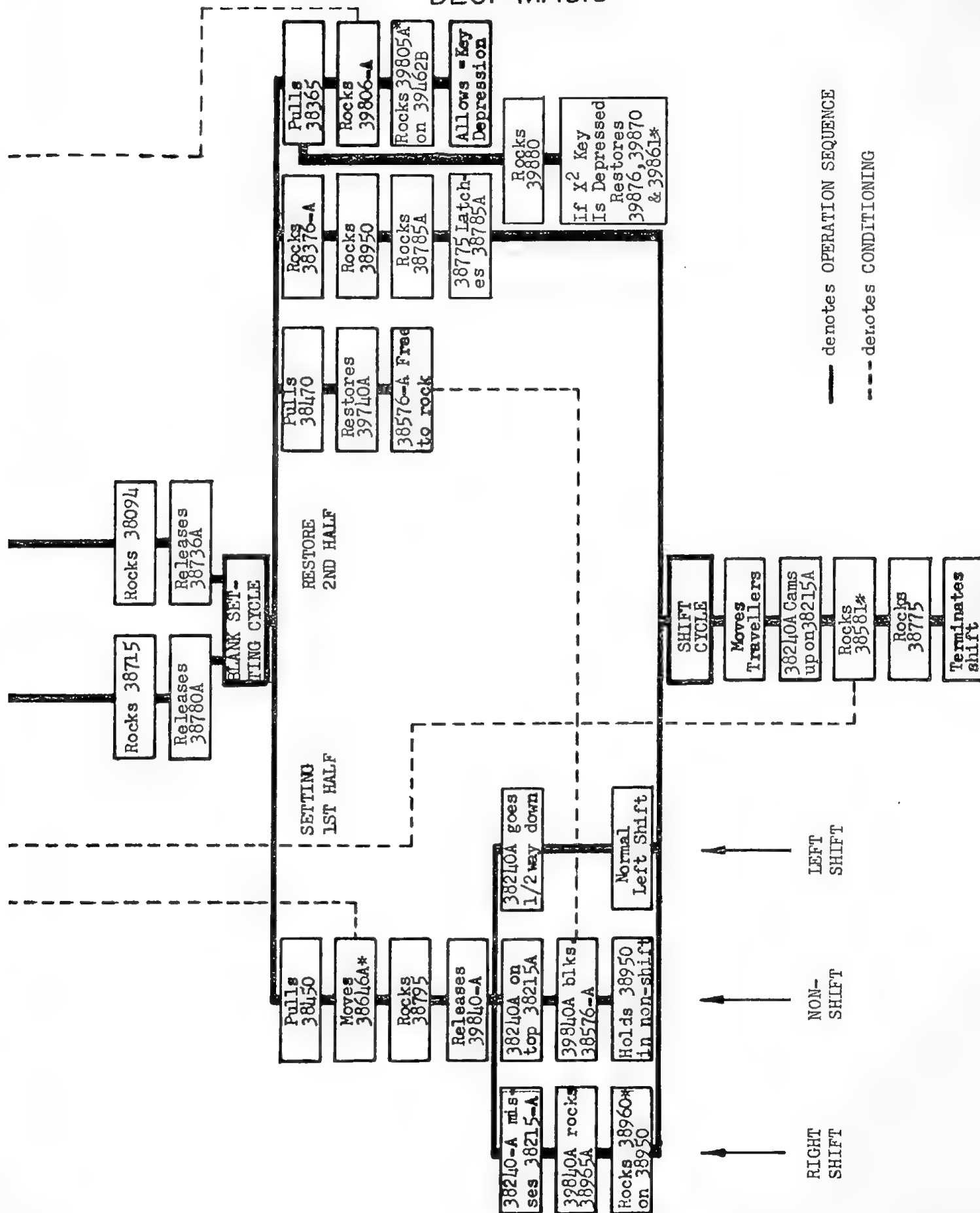
The Shift-Clear Interlock on the Switch Pinning has the same functions as in previous machines. Separate interlocks are provided for:

- A. Add-Division and Sub.-Division
- B. Add-Multiply and Sub.-Multiply
- C. Multiply Equals
- D. Equals Keys
- E. Multiply - Division
- F. Division - Tab
- G. Square - Front Dial Lock
- H. Division-Dividend
- J. Other Interlocks:

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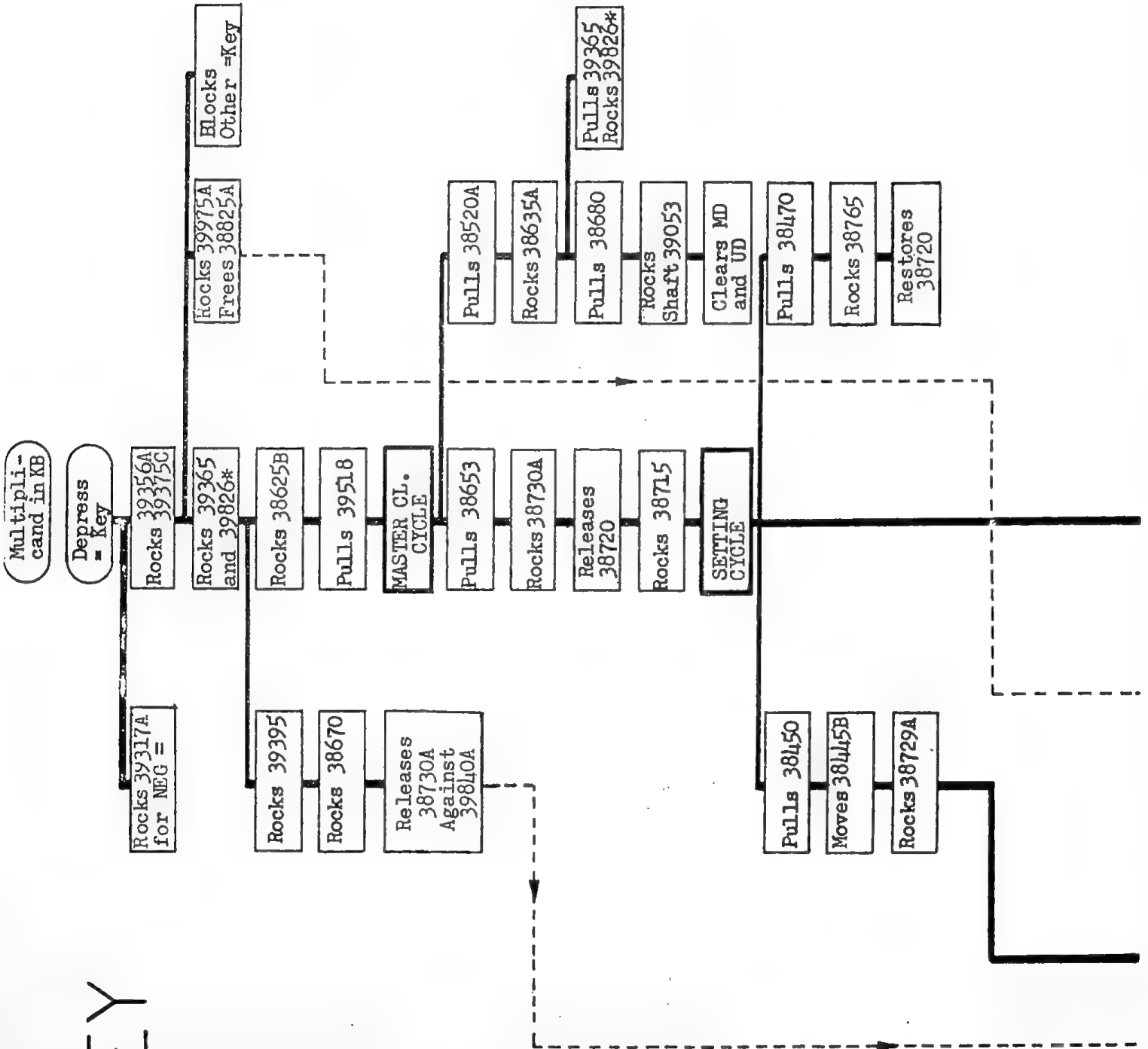


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= KEY



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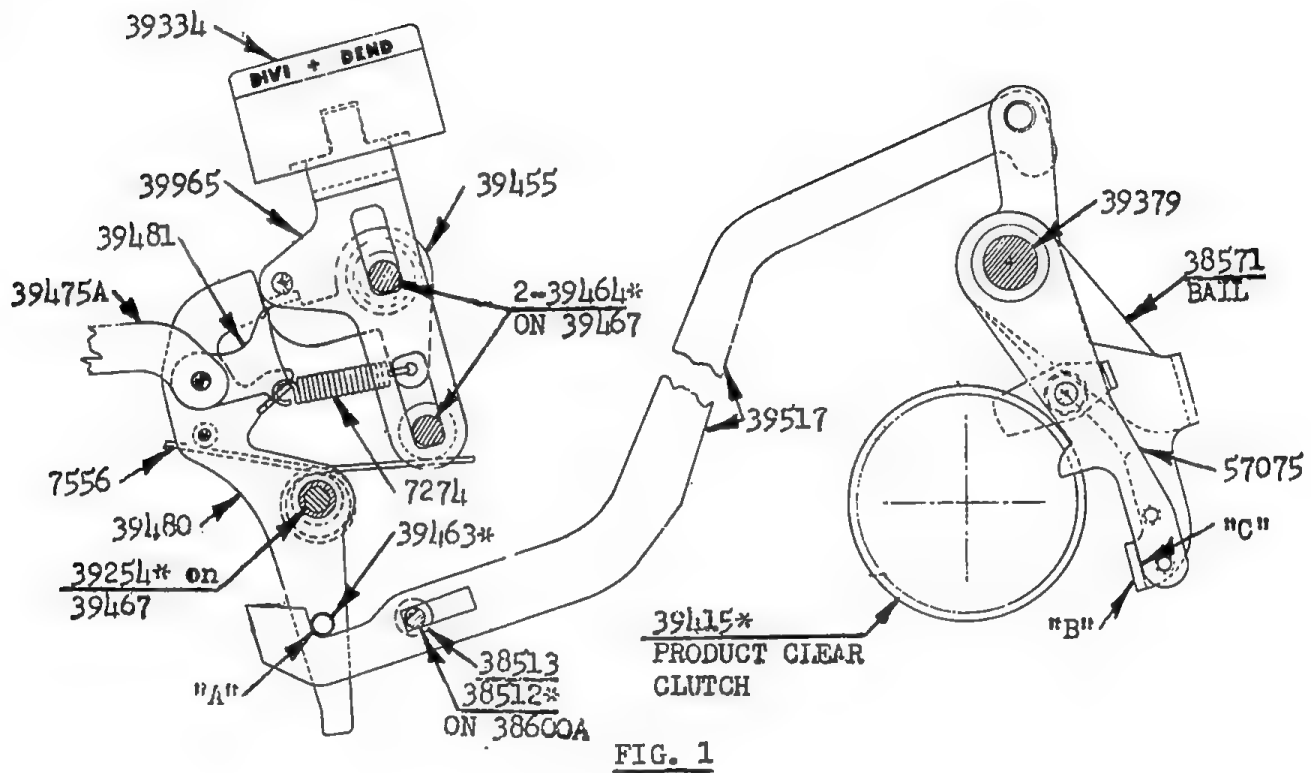


FIG. 1

I. DIVIDEND KEY:

A. Invariable Middle Dial Clearance:

1. (Fig. 1). Depression of the Dividend Key Stem 39965 releases the Dividend Entry Hatchet-39480 through Interponent 39455. The Stud-39463* on the lower portion of Hatchet-39480 pulls the Middle Dial Clutch Control Link-39517 at surface "A" forward, rocking the Control Bail-38571 counter-clockwise. Ear "B" on Bail-38571, underlies surface "C" on the

Product Clear Clutch Release Dog-57075 and rocks 57075 rearward, thus opening the Product Clear Clutch-39415*. If the Key-39965 is held depressed, continuous operation of Hatchet-39480 is prevented by the Dividend Entry Hatchet Live Point-39481 which is attached to Hatchet-39480 and which snaps in front of the ear on Interponent-39455 when the Hatchet-39480 is restored.

B. Opening of the Master Clutch:

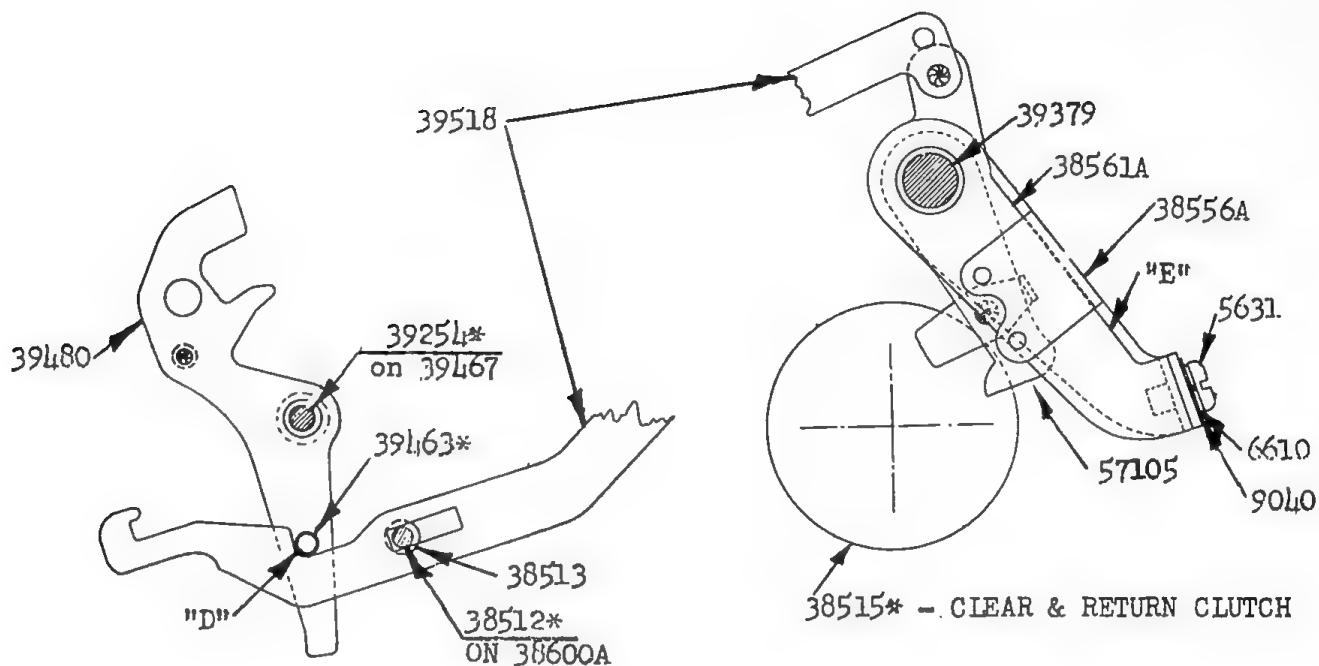


FIG. 2

1. (Fig. 2). The Stud-39463* on the lower portion of Hatchet-39480, also pulls the Master Clutch Control Link-39518 at surface "D" forward, rocking the Master Clutch Control Arm - Left -38556A counter-clockwise. Arm "E" of Master Clutch Arm-38561A, underlies Lever-57105 and rocks 57105 rearward, thus opening the Clear and Return Clutch-38515*, commonly referred to as the "Master Clutch"-38515*.

C. Upper Dial Clearance:

1. (Fig. 3 & 4). Rotation of the

Clear and Return Clutch rotates the Master Clear Cam-38526*, (Fig. 3), on 38525 counter-clockwise. This counter-clockwise movement of Cam-38526*, in turn, moves the Outer Master Power Bail-38530 counter-clockwise. The Master Clutch Power Link #2 - 38520A, being attached to Bail-38530, is moved rearward and this movement rocks the Starting Lever Release Lever-38635A counter-clockwise. The Front Master Control Power Link-38680, which has its

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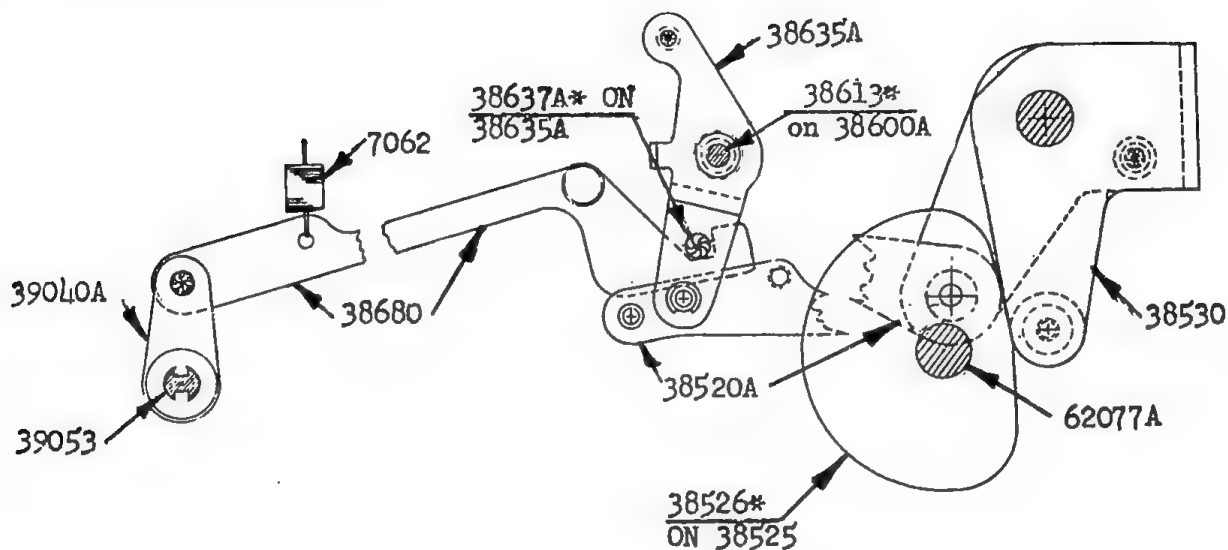


FIG. 3

hooked end in engagement with Stud-38637A* on Lever-38635A, is pulled rearward, thus rocking the Clear Shaft-39053 clockwise through keyed Clear Shaft Drive Link-39040A. As Clear Shaft-39053 rocks clockwise, (Fig. 4), ear "F" on keyed Clear Arm Rocking Lever-39096 contacts surface "G" on the Clear Operating Arm-39065A and rocks 39065A clockwise. Surface "H" on the Clear Arm Operating Live Point-39071*, mounted on Arm-39065A, contacts Stud-39082A* on the Upper Dial Clear Bail-39080A which pulls the Counter Clear Release Link-38741*

forward, opening the clear clutch in the standard manner.

2. Upper Dial Clearance does not occur if the Clear Lock Key-39055 is depressed. This action is

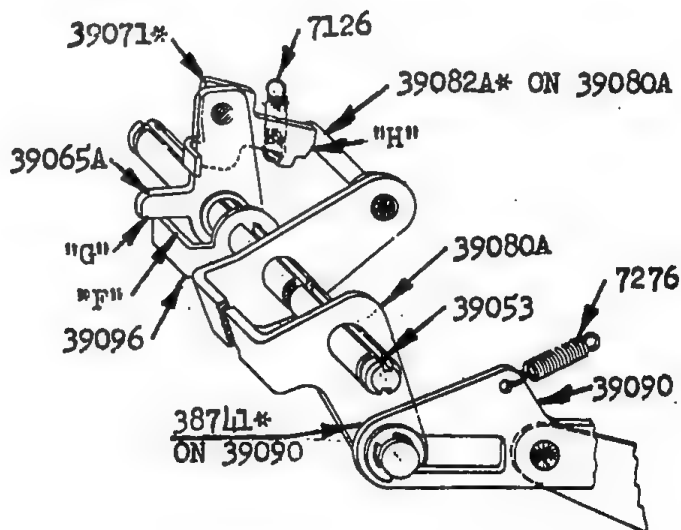


FIG. 4

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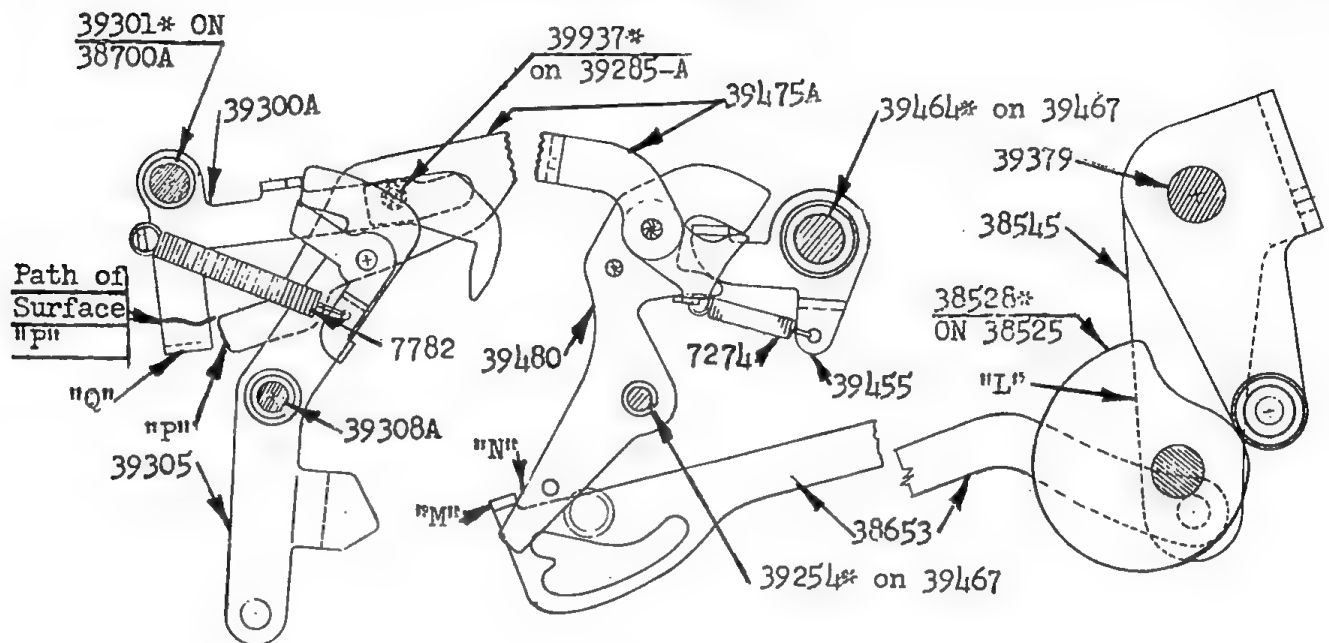


FIG. 5

described and illustrated in Section XV - Para. "C" on Page 1296.

3. NOTE: Rotation of Clear Shaft-39053 also opens the Middle Dial Clear Clutch. However, in the particular case of the Dividend Entry Key the Middle Dial Clear Clutch is opened directly through Link-39517, (Fig. 1), and can therefore not be disabled by the M. D. Lock Key.

D. Adding Keyboard Entry into Middle Dial and Selective Keyboard Clearance:

1. (Fig. 5). Rotation of the Clear

and Return Clutch-38515* also rotates the Master Power Cam-38528* on 38525, counter-clockwise which, in turn, rocks the Inner Master Power Bail-38545 counter-clockwise, pulling the Master Clutch Power Link-38653, rearward through Arm "L". Upon rearward movement of Link-38653, its ear "M" contacts surface "N" on Hatchet-39480 and rocks it counter-clockwise, restoring Hatchet-39480 to its normal latched position. As Hatchet-39480 is restored, surface "P" on the Add Operating Link-39475A, which

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is guided by Stud-39937* on Add Key Frame-39285A, contacts ear "Q" on the Add Bellcrank-39300A and rocks it clockwise, thus releasing the Add Operating Lever-39305 and initiating an add cycle. During the final phase of restore of Hatchet 39480, the surface "P" on Link-39475A is cammed upward, by the action of Stud-39937* in the camming slot of Link-39475A, and clear of ear "Q"

on the Add Bellcrank-39300A, allowing 39300A to return to its normal position at end of add cycle.

2. The Selective Keyboard Clearance which follows every Add Cycle is described and illustrated in Section III-Para. C-1 and C-2 on Pages 1245, 1246 and 1247.

3. NOTE: Due to the automatic decimal system on SKA no shift take place upon depression of the Dividend Entry Key.

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SECTION II:

DIVISION AND LINE-UP KEYS:

These Pages 1213 through 1243, including Figures 7 through 20, will be forwarded to you in the near future. Upon receipt of Section II, it should be inserted here, between Sections I and III, and this "blank" page destroyed.

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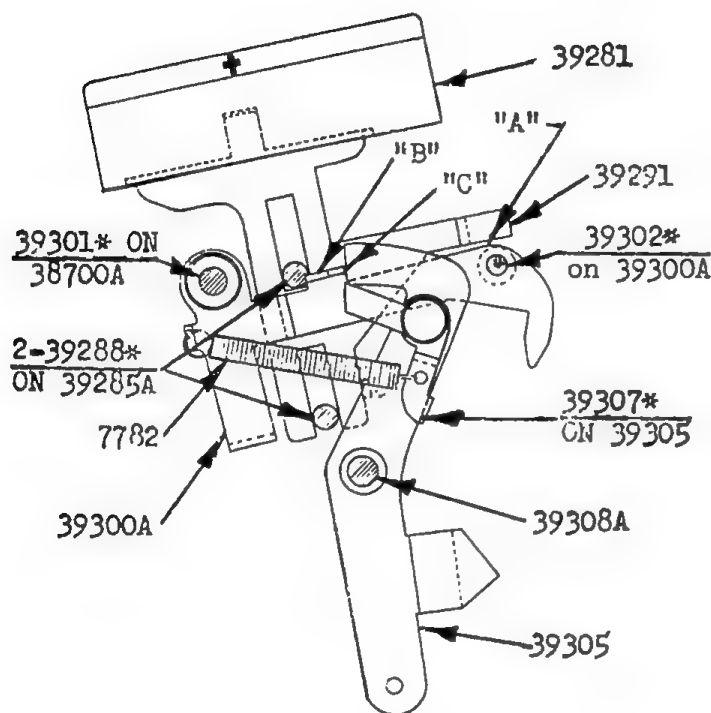


FIG. 21

III. ADD KEY:

A. Initiation of Add Cycle:

1. (Fig. 21 & 22). Depression of Add Key Stem-39291 causes its surface "A" to contact Stud-39302* on the Add Bellcrank 39300A and rocks 39300A clockwise, thereby moving ear "B" on 39300A down and away from surface "C" on the Add Operating Lever-39305 and allowing 39305, under tension of Spring-7782 to rock counter-clockwise. A repeat add cycle due to holding Key Stem-39291

depressed, is prevented by the Add Operating Live Point-39307* on 39305. As Lever-39305 moves counter-clockwise, (Fig. 22), its surface "D" contacts ear "E" on the Add Restore Bail-38351 and rocks it clockwise. Bail-38351 rocks the Add Starting Arm-38138 through Link-38141 and an adjustment screw 38139, which causes the surface "F" on 38138 to contact surface "G" on the Setting Clutch Opening Bail-38715, rocking 38715 clockwise, thus moving surface "H" on Bail-38715 away from under ear "J" on the Starting Control Lever-38780A and allowing 38780A to engage the ratchet for an active cycle, opening the setting clutch. (See also Section II, which will be forwarded to you at a later date).

B. Restore:

1. (Fig. 22). On the restore phase of the setting cycle, the Add Restore Cam-38390 rocks the Add Restore Bellcrank-38360 counter-clockwise, thereby moving the Add Restore Link-38365

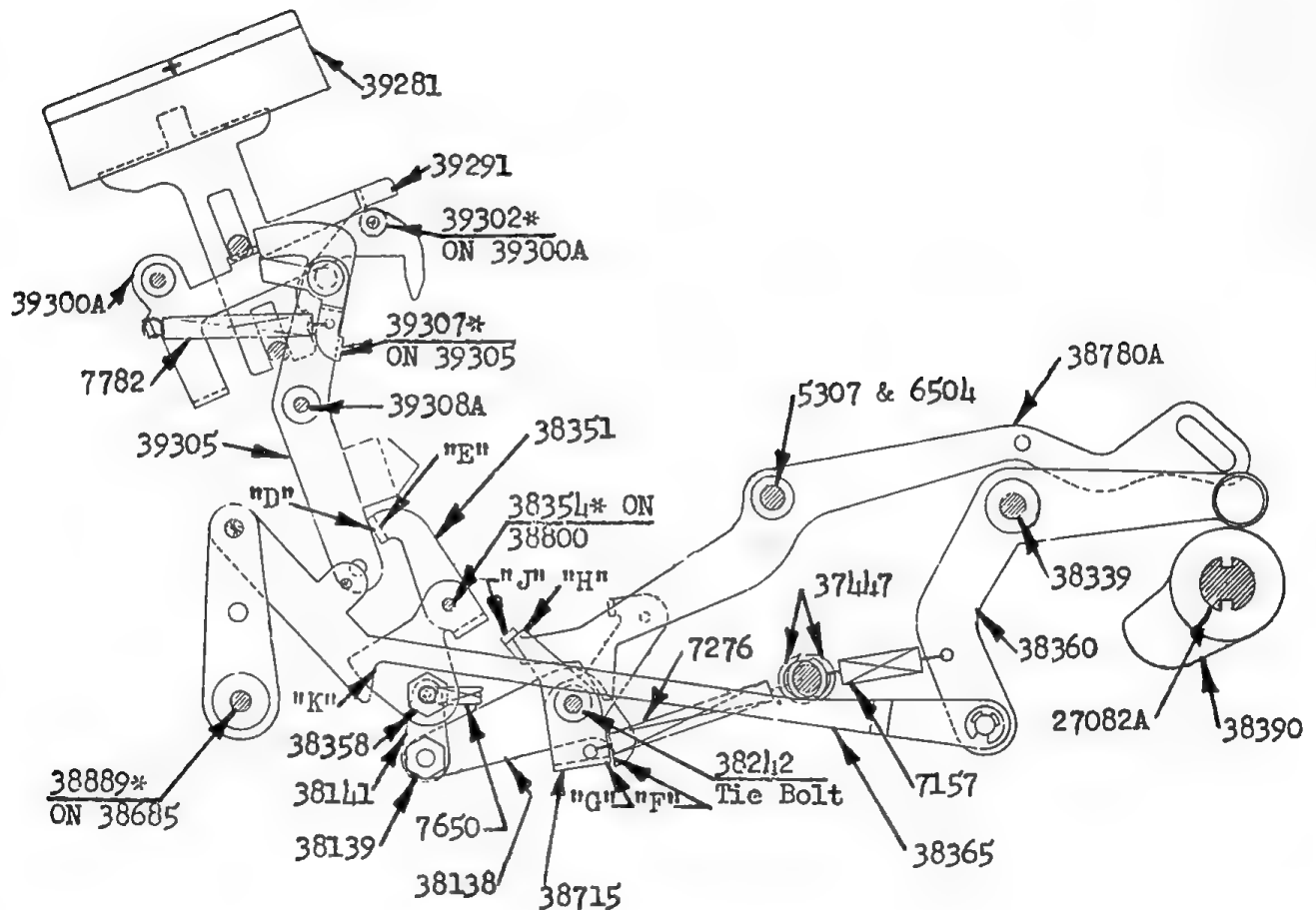


FIG. 22

rearward and causing surface "K" on 38365 to contact the Eccentric Stud-38358. Eccentric 38358 being connected to the Add Restore Bail-38351 causes 38351 to rock counter-clockwise, thereby restoring the Add Operating Lever-39305 to its

normal latched position through ear "E" on 38351 contacting surface "D" on 39305.

C. Selective Keyboard Clearance:

1. (Fig. 23). As the Add Operating Lever-39305 is restored, it moves the Add Keyboard Clear Link-38392

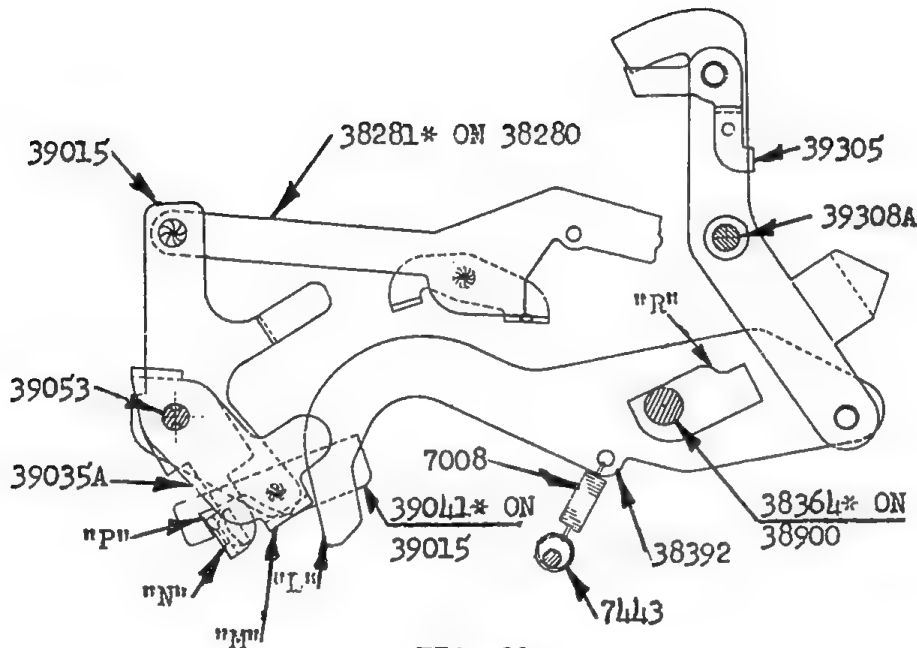


FIG. 23

forward. Surface "L" on Link-38392, which is guided by Guide Stud-38364* on Center Frame-38900, contacts ear "M" on the right arm of the Automatic Keyboard Clear Bail-39035A and rocks 39035A clockwise. Ear "N" on the left arm of 39035A contacts hook "P" on the Automatic Keyboard Clear Live Point 39041*, which is mounted on the Keyboard Clear Lever-39015, and rocks 39015 clockwise, thereby clearing the keyboard selectively through the Selective

Keyboard Clear Bail-38280, as described in Section XII-Para. A on Pages 1293 & 1294. (If the K.B. Lock Key is depressed hook "P" will be held out of the path of ear "N" and no clearance will occur.)

2. (Fig. 23). As Link-38392 completes its forward motion, its Guide Stud-38364* cams surface "R" in the slot upward and thus moves surface "L" over ear "M" which allows 39035A to return to its normal counter-clockwise position. (Compare with Link-39475A in Section I-Para. D-1 on

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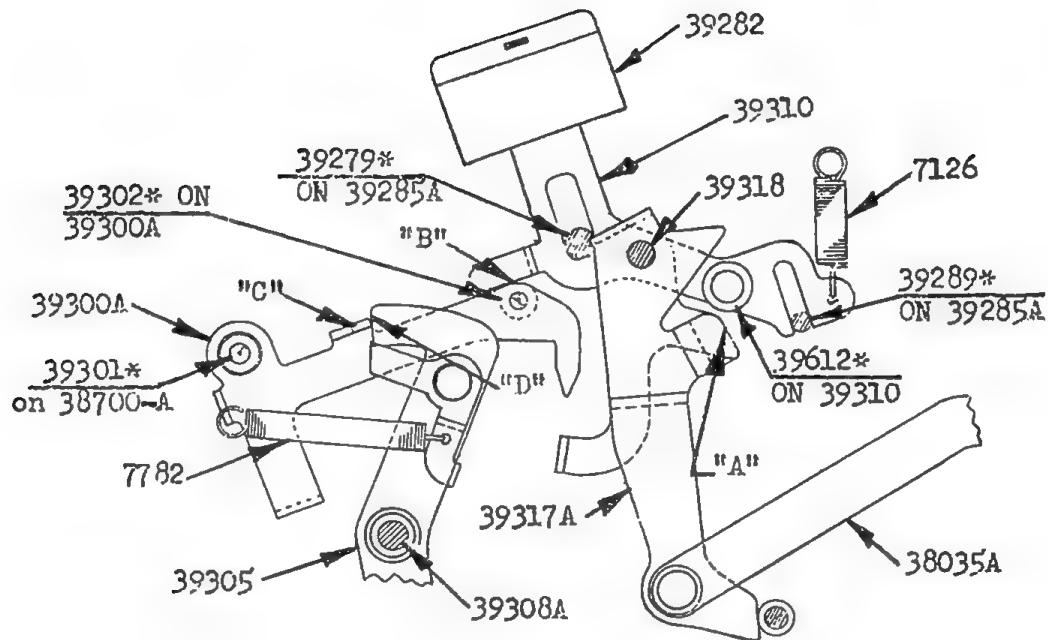


FIG. 24

Pages 1211 and 1212 for similar action).

IV. SUBTRACT KEY:

A. Initiation of Subtract Cycle:

1. (Fig. 24). Depression of the Subtract Key Stem-39310 causes its Roller-39612* to contact surface "A" on the Reverse Setting Bail-39317A and rocks 39317A clockwise, thus moving the Reverse Setting Bar-38035A forward, which positions 38035A for negative actuation in the standard manner. Upon depression,

surface "B" on the Subtract Key Stem-39310 contacts Stud-39302* on the Add Bellcrank-39300A and rocks 39300A clockwise, thereby rocking its ear "C" down and away from surface "D" on the Add Operating Lever-39305 and allows 39305 to initiate a cycle in the same manner as in add key depression.

V. MULTIPLIER KEY:

Multiplication Principle: In order

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to study the storage multiplication on the "Deci•Magic", Model SKA, it is first necessary to fully understand the basic difference between this and all other previous Marchant models. On SKA a storage mechanism under the Keyboard fulfills the functions of the old Multiplier Key section. Both factors "a" and "b" of a problem $a \times b = c$ are entered successively into the Selection Keyboard, separated by depression of the "Multiply" (X) Key and followed by depression of an "Equals" (=) Key: exactly the sequence in which the problem is written above. It should be kept in mind, however, that the first factor to be entered serves as the multiplier and its digits are therefore equivalent to the entries in the old Multiplier Key section, while the second entry (Multiplicand) on SKA is equivalent to the first entry (and only Selection Keyboard entry) on the

standard models. For example, the following problem shall be solved:

$$2.308 \times 45.6 = c$$

1. Enter 2.308 into the Keyboard around a pre-selected decimal;
2. Depress the "X" Key;
3. Enter 45.6 into the Keyboard around the same decimal as before;
4. Depress the "=" Key, the machine will now automatically:

multiply 45.6 x 2;

shift left one order;

multiply 45.6 x 3;

shift left two orders through the "0" in 2.308;

multiply 45.6 x 8;

shift back to its decimal position to point out the answer in the middle dials correctly.

A. SETTING KEYBOARD ENTRY INTO MULTIPLIER CHECK DIALS:

1. (FIG. 25). Depression of the Multiplier Key 39336A rocks the Multiplier Key Bail-39370 through a slot in the key stem engaging Stud-39779* on 39370. Surface "A"

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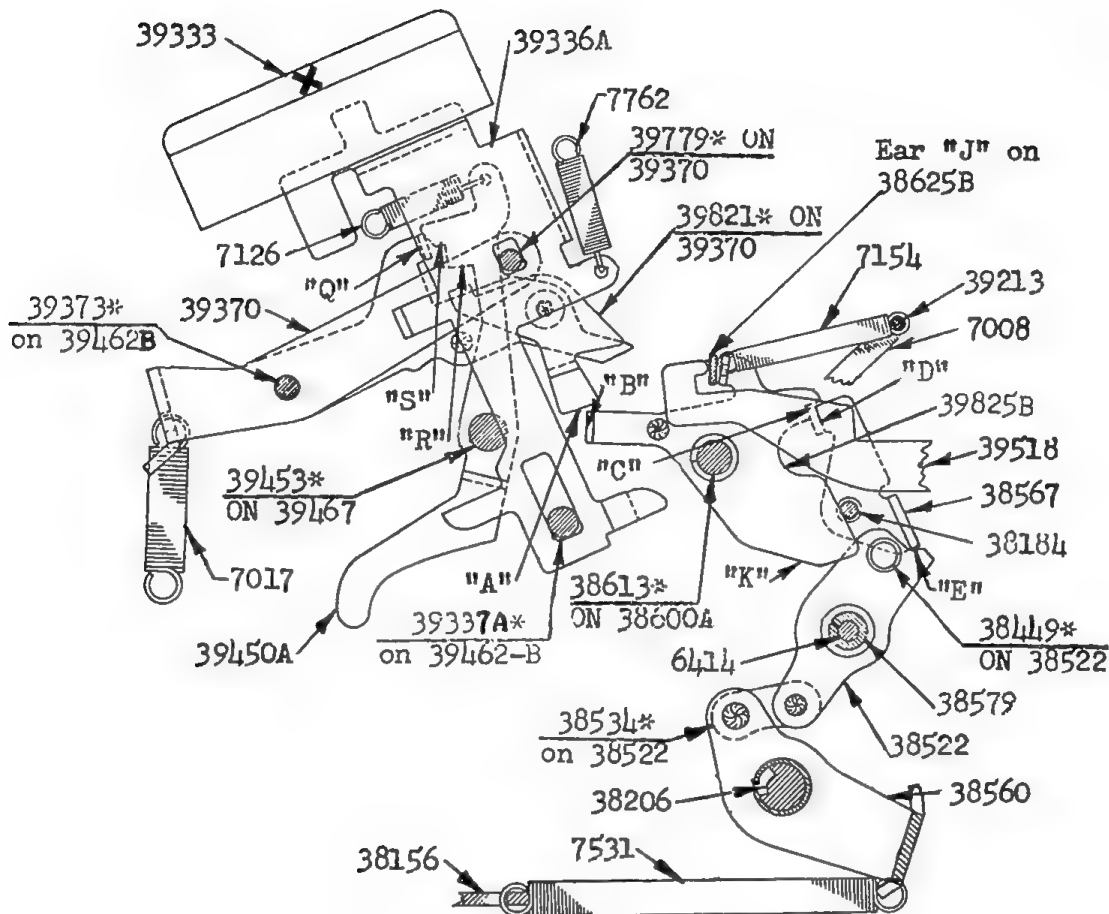


FIG. 25

on the Multiplier Key Bail Live Point 39821* contacts ear "B" on the Multiplier Selection Primary Latch 39825B and rocks it counter-clockwise. This removes the latching surface "C" from ear "D" on the Multiplier Selection Intermediate Latch-38567 and permits 38567 to rock counter-clockwise under tension of Spring-7531 on the Multiplier Selection Bail-

38560 which transmits its force to the camming surface "E" on the Multiplier Selection Restore Lever-38522 through the Multiplier Selection Restore Links 38534*. The Multiplier Selection Bail-38560 is thus permitted to rock clockwise.

2. (Fig. 26). When Bail-38560 is released it allows the Multiplier Storage Mechanism under the Keyboard to

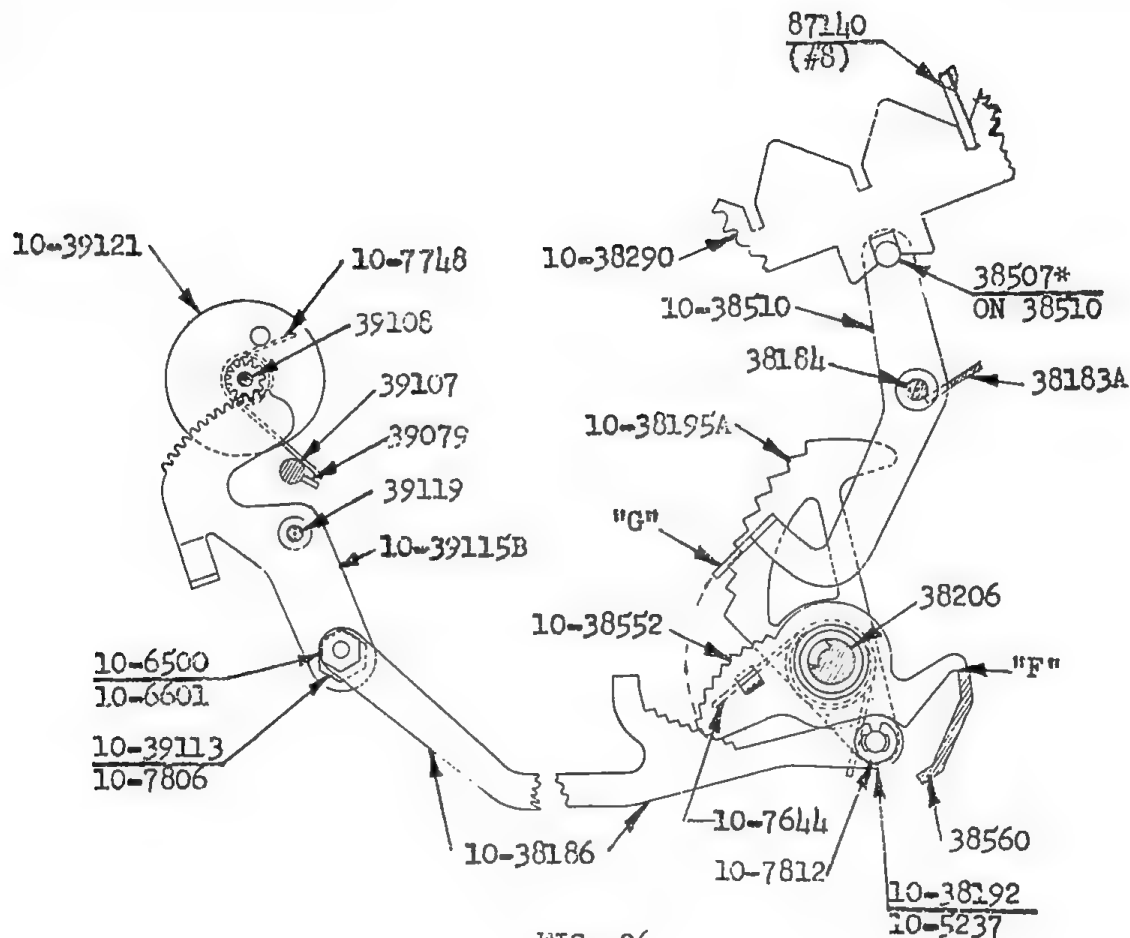


FIG. 26

take a position which in each order represents the amount of the Keyboard entry, by removing the blocking surface "F" on 38560 from the Multiplier Selection Step Cams-38552. Springs-7748, which drive the Multiplier Check Dials-39121 from "0" towards the selection, are no longer overpowered by Springs 7644 and can now rock the Step Cams-38552 through Multiplier Selection Segments-39115B

the Multiplier Selection Links-38186 and the Multiplier Step Cams-38195A, until the 38552-Step Cams stop against ears "G" on the Multiplier Selection Levers-38510. The Levers-38510 have been positioned by the Selector Key Stems-87140 through the Selection Bars-38290 so that the positions of the 38552's represent the Keyboard selection. The two Step Cams-38552 and 38195A will move as a unit with

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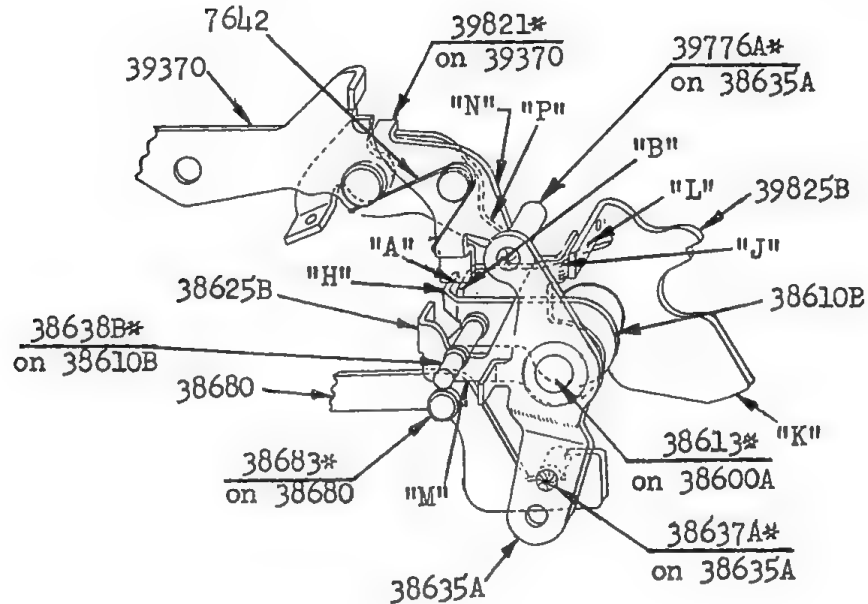


FIG. 27

each other through Torsion Springs-7644, which at this time exert no external force on the system.

3. (Fig. 25 & 27). In addition to rocking 39825B, the surface "A" on the Multiplier Key Bail Live Point-39821* also rocks the Multiplier Starting Lever-38610B through its ear "H" which, in turn, rocks the Equals Starting Lever-38625B counter-clockwise through Stud-38638B* on 38610B. (Figs. 25 & 27). Ear "J" on 38625B pulls the Master Clutch Control Link-39518 forward and opens the

Master Clutch in the same manner as the Dividend Key. (Section I-Para. B-1 on Pages 1208 & 1209). To assure opening the Master Clutch upon release of Bail-38560 in case of a sharp partial depression of the X-Key, a surface "K" is provided on 39825B which is cammed counter-clockwise by Spacer-38449* on 38522 when 38522 is released to rock counter-clockwise. (Fig. 25). Counter-clockwise movement of 39825B brings its ear "L" into contact with ear "J" on 38625B which positively

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opens the Master Clutch.

4. (FIG. 27). Clearance of the Carriage Dials on X-Key depression is disabled by disconnecting the Front Master Power Link-38680 from the Starting Lever Release Lever-38635A which rocks counter-clockwise on Master Clutch Cycle. (See Section I-Para. C-1 on Pages 1209 and 1210). When 38610B is rocked counter-clockwise its surface "M" moves Stud 38683* on 38680 down and thus rocks the hook on 38680 out of engagement with Stud-38637A* on 38635A, breaking the connection to Clear Shaft-39053. (Fig. 3 on Page 1210)

5. (Fig. 25 & 27). Rotation of Master Clutch rocks Lever-38635A counter-clockwise. Stud-39776A* on 38635A will now contact the surface "N" on the Live Point-39821* and rock 39821* so that its surface "A" comes clear of the Ears "B" and "H", allowing the Bail-39370 to be latched down and limiting Master Clutch to one cycle while the Levers-38610B and 39825B return to their normal posi-

tions. Stud-39776A* also contacts surface "P" on Bail -39370 and rocks it farther clockwise to allow its ear "Q" to be latched by surface "R" on the X Bail Latch-39450A.(FIG. 25). The first Latching surface "S" on 39450A is to prevent a jamming condition in the event that the X Key is depressed sharply in such a manner that after opening of the Master Clutch the Bail-39370 would come back to a position where the Stud-39776A* on 38635A could hit the very tip of the surface "P" on 39370.

6. (FIG. 28 & 29). The Multiplier Selection Lock Latch Live Tip-38569* on Assembly-38568 is normally held depressed by Spacer-38449* on Lever 38522. (FIG. 28 & 29). As Bail-38560 is released, Lever-38522 is rocked counter-clockwise to carry its Spacer 38449* forward and away from surface "T" on Live Tip-38569* and allows 38569* to

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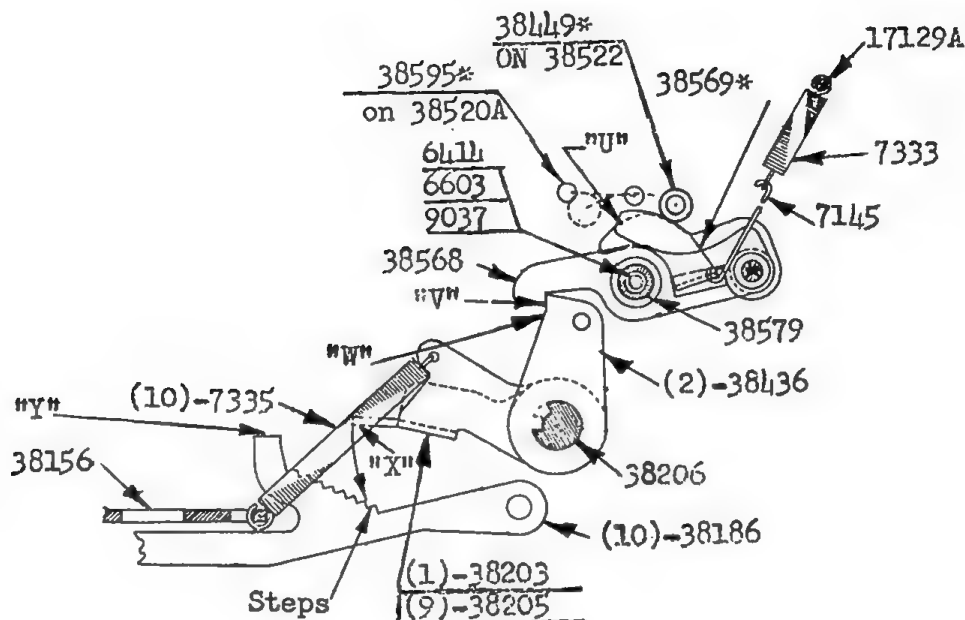


FIG. 28

spring upward, positioning its surface "U" into the path of Stud-38595* on the Master Clutch Power Link #2-38520A, thus positioning the Live Tip-38569* for power release of the Selection Recock Arm-38436, which is keyed to the Multiplier Selection Shaft-38206. (Fig. 28).

As Link-38520A moves rearward on the Master Clutch Cycle, (See Section I, Para. C-1 on Pages 1209 and 1210), its Stud-38595* contacts surface "U" on Live Tip-38569* and rocks the Multiplier Selection Lock and Live Tip-38568 clockwise, thereby releasing its

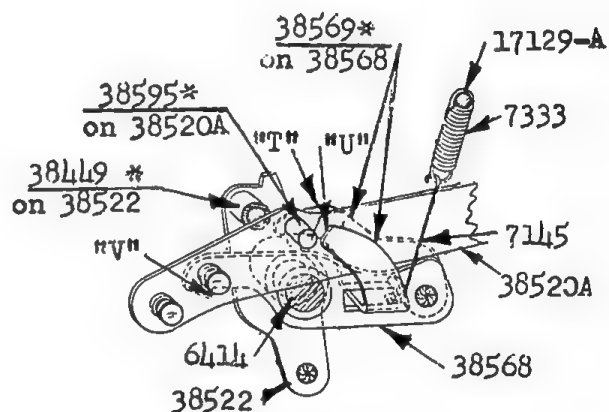


FIG. 29

surface "V" from surface "W" on the Selection Recock Arm-38436 (which is tightly keyed on Shaft-38206) allowing Arm-38436 and Shaft-38206 to rock counter-clockwise. 7. (FIG. 28). The Multiplier Selection Locks-38205, one for each of

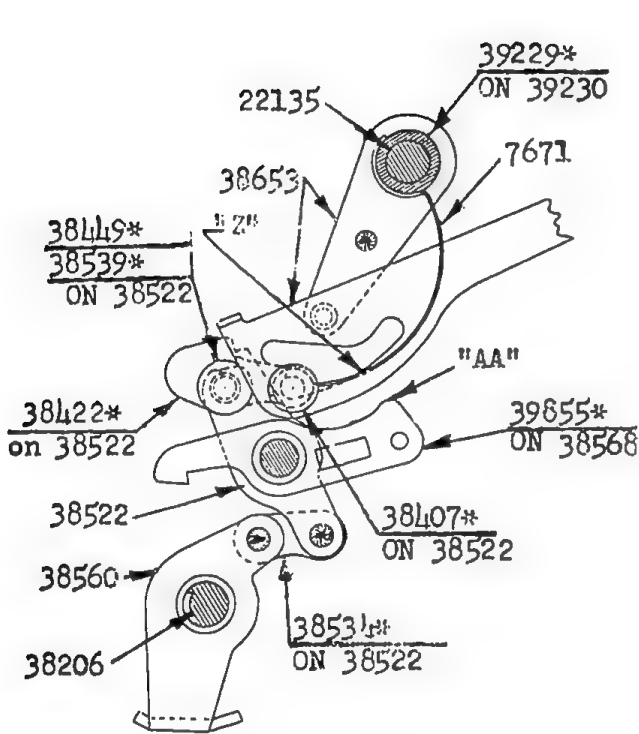


FIG. 30

nine orders, and the Multiplier Selection Lock-Right-38203, right end order only, are all pivoted on the Multiplier Selection Shaft-38206 and loosely keyed to it. When Shaft-38206 is released, the Selection Locks-38205 and 38203 rock counter-clockwise under the urging of their Springs 7335. Surface "X" on each Lock-38205 and 38203 engage a step on its respective Multiplier Selection Link-38186, thus locking

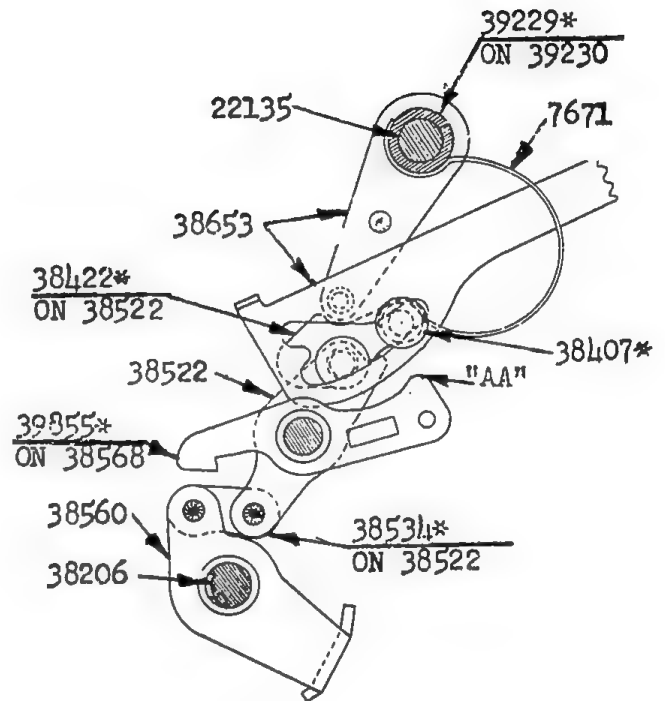


FIG. 31

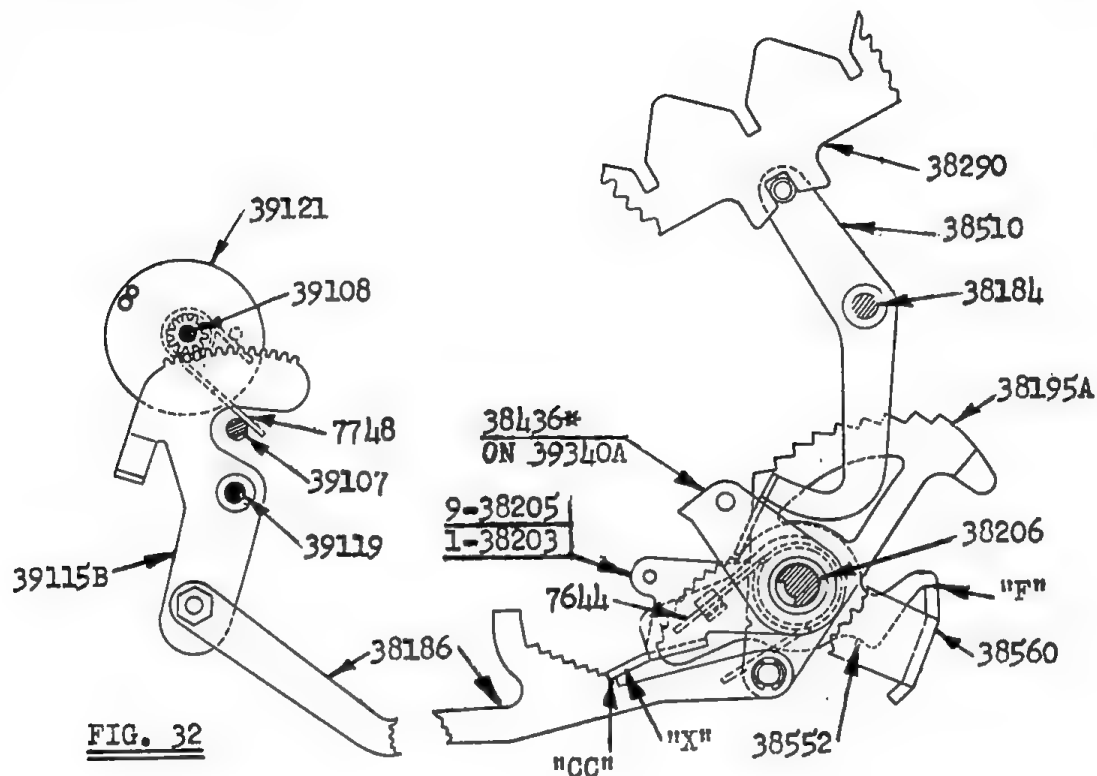
the selection. If in any order the Keyboard Selection is "0" the Link-38186 has not been moved out of its normal "Zero" position, (per Section V-Para. A-2 on Pages 1249, 1250 & 1251), and the Locks-38205 and 38203 therefore come to rest on top of the "Zero" step "Y" on Link-38186 8. (Fig. 30 & 31). Riveted to the upper end of Lever-38522 is the Multiplier Selection Restore Live Tip-38422*. The rearward end of

38422* carries a Stud-38407* which is spring urged downward by Spring 7671. Stud-38407* is engaged in a slot "Z" on the Master Power Link-38653, and when the Lever-38522 is released by the X-Key (as previously described) the Stud-38407* tracks forward along the lower contour of the slot "Z". On the Master Clutch Cycle the Link-38653 is pulled rearward, (See Section I-Para. D-1 on Pages 1211 and 1212), and thus restores Bail-38560 and the parts associated with it back to their normal latched positions. 9. (Fig. 31). On any Master Clutch Cycle, (other than the one produced by X-Key depression), Lever-38522 remains latched clockwise, in which position the rear end of its Live Tip-38422* lies directly above a nose "AA" on the rear portion of the Multiplier Selection Lock Latch 39855*. As Link-38653 moves in an essentially circular path around Shaft-22135 the down-

wardly spring urged Stud-38407* will follow the lower contour of slot "Z" until its clockwise motion is stopped by the nose "AA" on 39855*. As Link-38653 completes its movement the elongated upper portion of slot "Z" is so oriented that it will accommodate the Stud-38407* without disturbing the Live Tip's position of rest on nose "AA", and, being longer than the lower portion, will allow the Link-38653 to move to the end of its rearward stroke without pulling Stud-38407*. Thus, the Bail-38560 will not be overstroked when it is not actually being restored, which prevents unnecessary loading of the restore mechanism.

10. (Fig. 32). When Bail-38560 is restored counter-clockwise its surface "F" contacts the Step Cams-38552 (which may be in any of the positions, "0" to "9") and restores them.

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Since the Selection Links-38186 are now latched by Locking Levers-38205 & 38203, the Step Cams-38195A are held in their positions so that they cannot follow the counter-clockwise movement of the Step Cams-38552 beyond a point where the Steps "CC" on the Links-38186 contact ears "X" on their respective Locks-38205 and 38203. Beyond this point the Springs 7644 will be tensioned, thereby holding the Link-38186, (and also the

Dials-39121), firmly in their final positions. This leaves the storage mechanism in the following condition towards the end of the Master Clutch Cycle: Bail-38560 is back in its starting position; Locks-38205 and 38203 hold the Links-38186 and the Step Cams-38195A and therefore the Dials-39121 in their selected positions; Shaft-38206 and its Arm-38436* are in a released, counter-clockwise position; Levers-38510 are in a position

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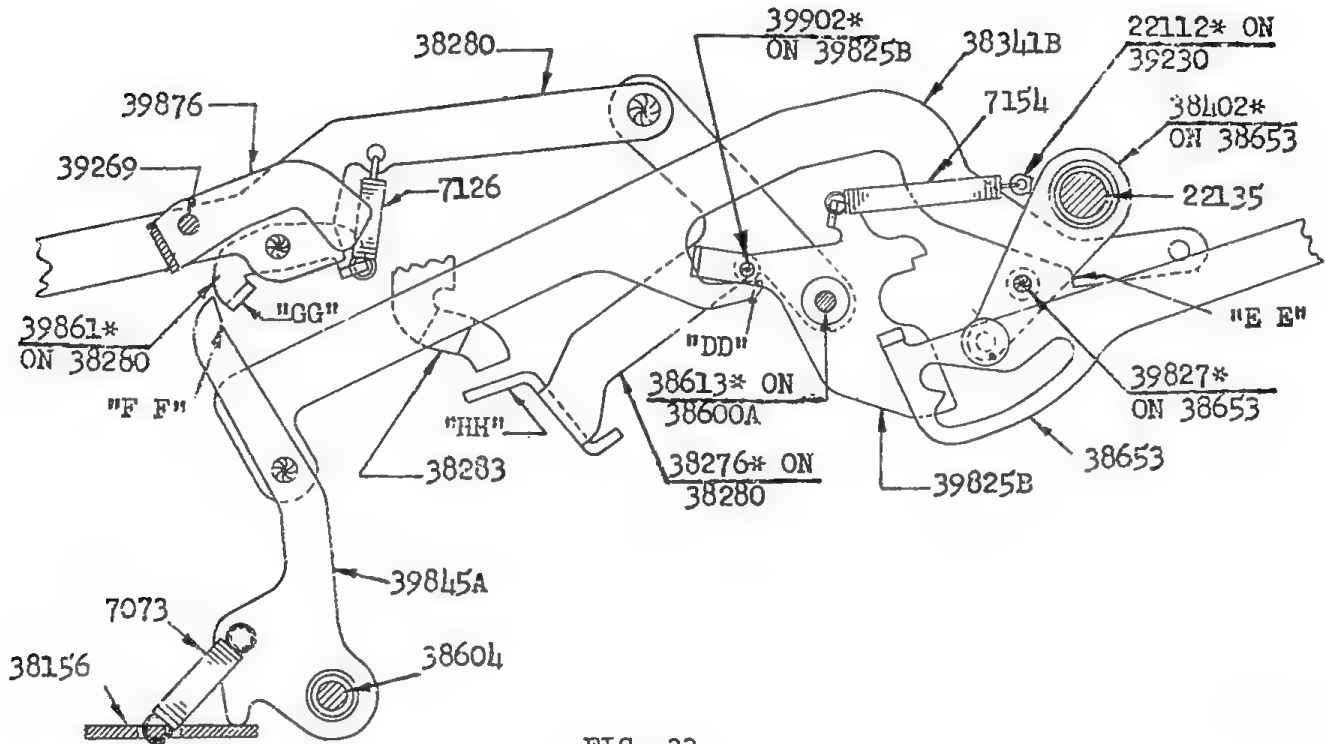


FIG. 33

representing a Zero Keyboard entry, since Link-38653 also has cleared the Keyboard as described below.

11. (Fig. 33). When the Primary Latch-39825B is rocked counter-clockwise by the X-Key, (Fig. 25), its Stud-39902* lowers the Mult. Keyboard Clear Link-38341B through surface "DD" and thus brings the surface "EE" into the path of Stud-39827* on Link-38653. During the final phase of the Master Clutch Cycle the Stud-39827* pulls the Link-38341B rearward

and thereby rocks the Mult. Keyboard Clear Lever-39845A clockwise. Surface "FF" on 39845A contacts ear "GG" on Live Point 39861* on the Selective Keyboard Clear Bail, and the Fingers "HH" rock the Levers-38283 up, thereby clearing the Keyboard in the standard manner. This returns the Selection Levers-3851C to their normal "Zero" position shown in Fig. 32. (Note that this Keyboard clearance on X-Key depression is not affected

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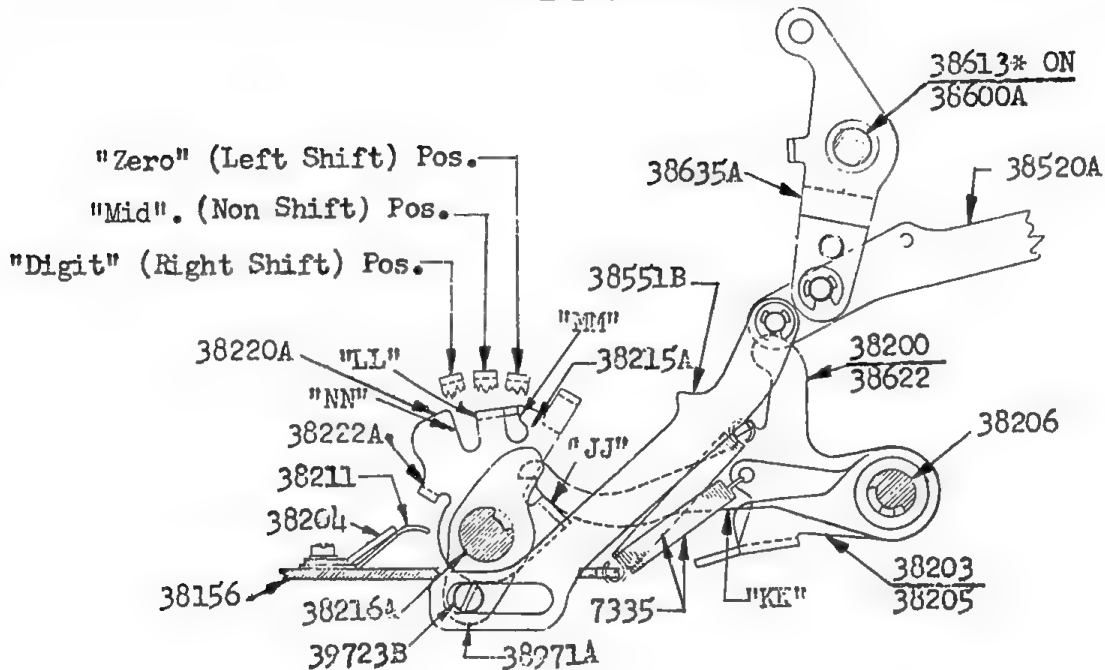


FIG. 34

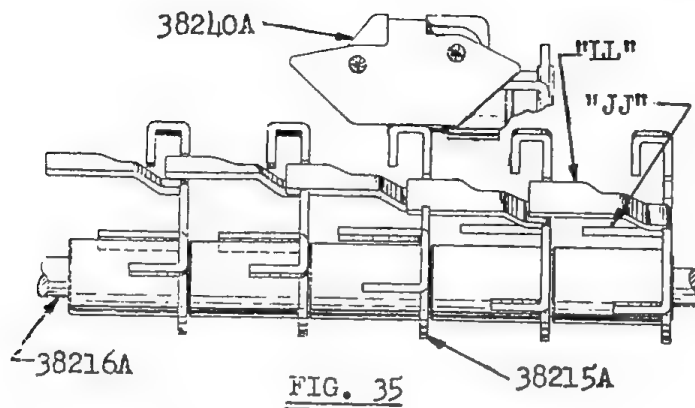
by the Keyboard Lock Key).

B. SETTING OF ORDINAL SHIFT CONTROLS ADD MULTIPLIER DELAY:

1. (Fig. 34). As explained in Section I-Para. C-1 on Pages 1209 & 1210, rotation of Master Clutch pulls Link-38520A rearward. Attached to the front end of 38520A is a Link-38551B which rotates Shaft-38216A and Double Lever-38971A, which is tightly keyed to Shaft-38216A. Loosely keyed to Shaft-38216A are the ordinal Shift Control Levers-38215A (and 38222A to the left of the leftmost order, 38220A in

the rightmost order) which are now rocked counter-clockwise against Leaf Spring-38211 to a point where the ordinal Locking Levers-38200 (and 38622 in the rightmost order) can fall behind the ears "JJ" on 38215A in any order in which a digit has been entered. This is determined by the Levers-38205 (or 38203) which are held in their upper position if no digit has been selected in that order. (See preceding Para. A-7 on Pages 1253 & 1254). In that case the surface "KK" on 38200 will be held

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up by its 38205 and the forward latching tip of 38200 will be high enough above ear "JJ" on 38215A so that the 38215A in that order cannot be latched.

2. (Fig. 34 & 35). Assuming the Keyboard entry is 00040.03000.

The Blocking Levers 38200 will be behind the ears "JJ" on 38215A in the 4th and 7th orders, and will be held above the ears in all other orders. However, due to the construction of the Levers-38215A, all 38215A's to the right of the leftmost digit (i.e., in orders 1 through 6) will also be held counter-clockwise in their "Right Shift" or "Digit" positions. This is achieved by the ears "LL" on 38215A which extend to the left

and overlie the surface "MM" in the 38215A adjacent to the left. Therefore, any digit will hold the Levers-38215A to the right of that order in a "Digit" position.

3. (Fig. 34 & 35). The Lever adjacent to the left of the leftmost digit (8th order in the example above, will be held in a "Non-Shift" or "Mid" position because its surface "NN" stops against the front face of ear "LL" on the 38215A in the 7th order. The surface "NN" on the 38215A in the 9th order will then stop against the front face of ear "LL" on the 38215A in the 8th order, therefore coming to rest in the "Left Shift" or "Zero" position. (Note that all 38215A's and the 38222A in "Left Shift" position also stop against the keyway in the Shaft-38216A at about the same time).

4. (Fig. 36). It now becomes necessary to initiate a "Blank

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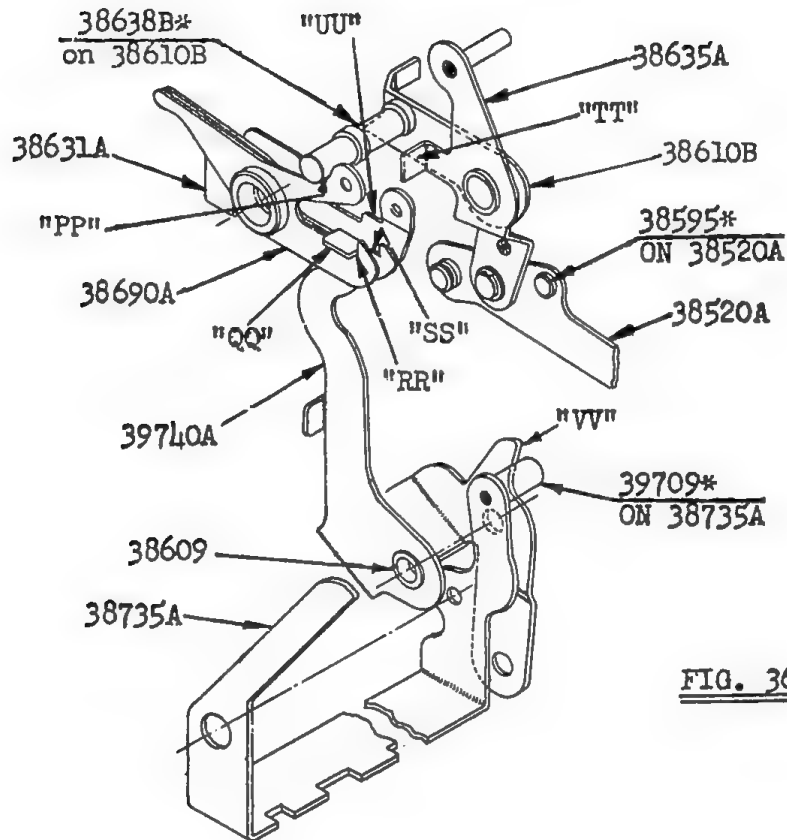


FIG. 36

Setting Cycle "in order to start the shift for alignment of the carriage with the leftmost multiplier digit. This is done by the Multiplier Starting Bail-39740A, which is latched by a pair of Latches-38690A and 38631A. The first Latch-38690A is released immediately upon X-Key depression by the Stud-38638B* on 38610B moving surface "PP" on 38690A down when 38610B is rocked as described in Para. A-3 on Pages 1251 and 1252.

The ear "QQ" on the Starting Bail-39740A can now escape past the latching surface "RR" and stops against latching surface "SS" on the second Latch 38631A. It remains there until, (on the Master Clutch Cycle), Link-38520A moves rearward, thereby rocking Release Lever-38635A counter-clockwise. 38635A has an ear "TT" which then comes down on surface "UU" on 38631A, rocking it clockwise, and releasing the ear "QQ" on

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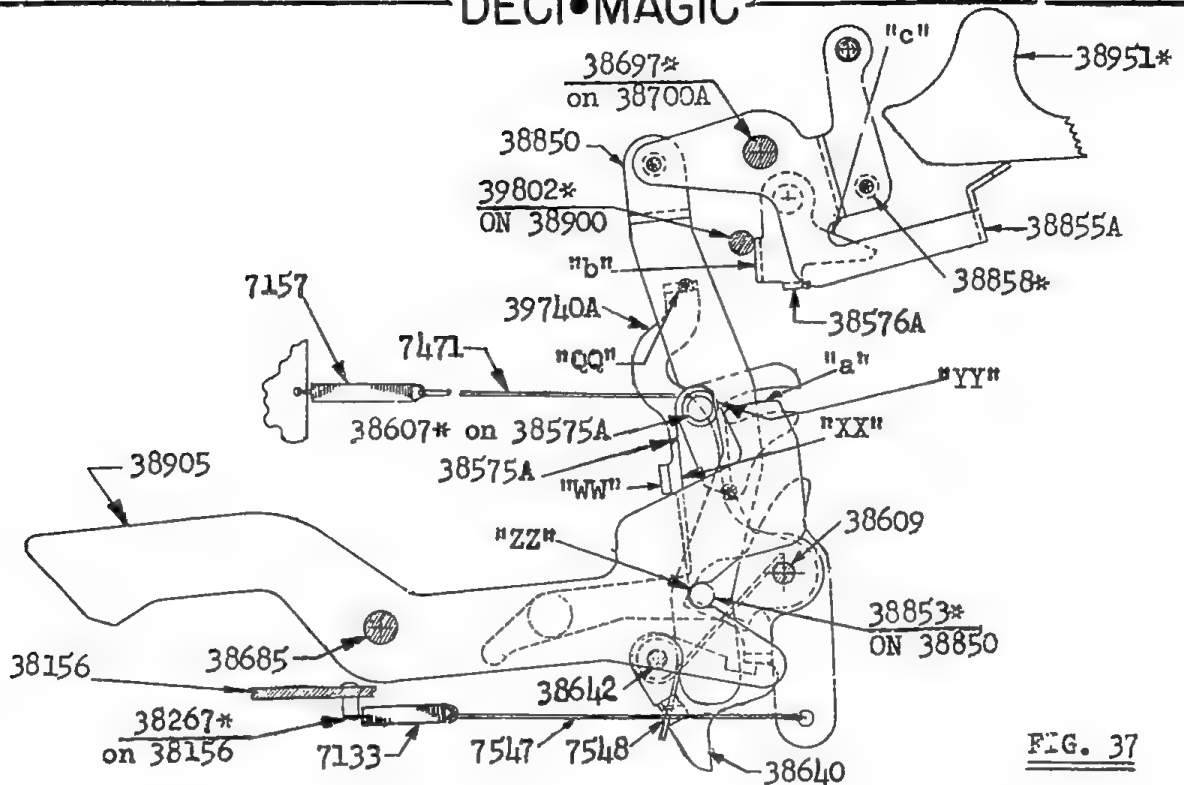


FIG. 37

39740A. 39740A now rocks clockwise under tension of its Spring-7133 and its nose "VV" contacts Stud-39709* on 38735A. This opens the Setting Clutch, (See Section III Para. A-1-Fig. 22 on Pages 1244 and 1245, for a "Blank Setting Cycle"). This delay insures that the Master Clutch Cycle is on its way before the Setting Clutch is opened.(Fig.37).

5. It should be noted here that, also at this time, the Starting Bail-39740A removes the last Restore Mechanism from the control of the Front Dial Clear Key and places

it under control of the Multiplier Mechanism. This, however, is without effect on the Multiplier Key operation and will be described in forthcoming Section VI-Para. C-1, pages 1278 & 1279.

C. Disconnection From Tab Control:

1. Fig. 37). In order to allow the carriage to shift into alignment with the leftmost multiplier digit, the shift mechanism must be disconnected from tab control and must be controlled by the ordinal Shift Control Members positioned by the Master Clutch Cycle. (See Para. B-1 thru B-5 on Pages 1258 thru 1261).

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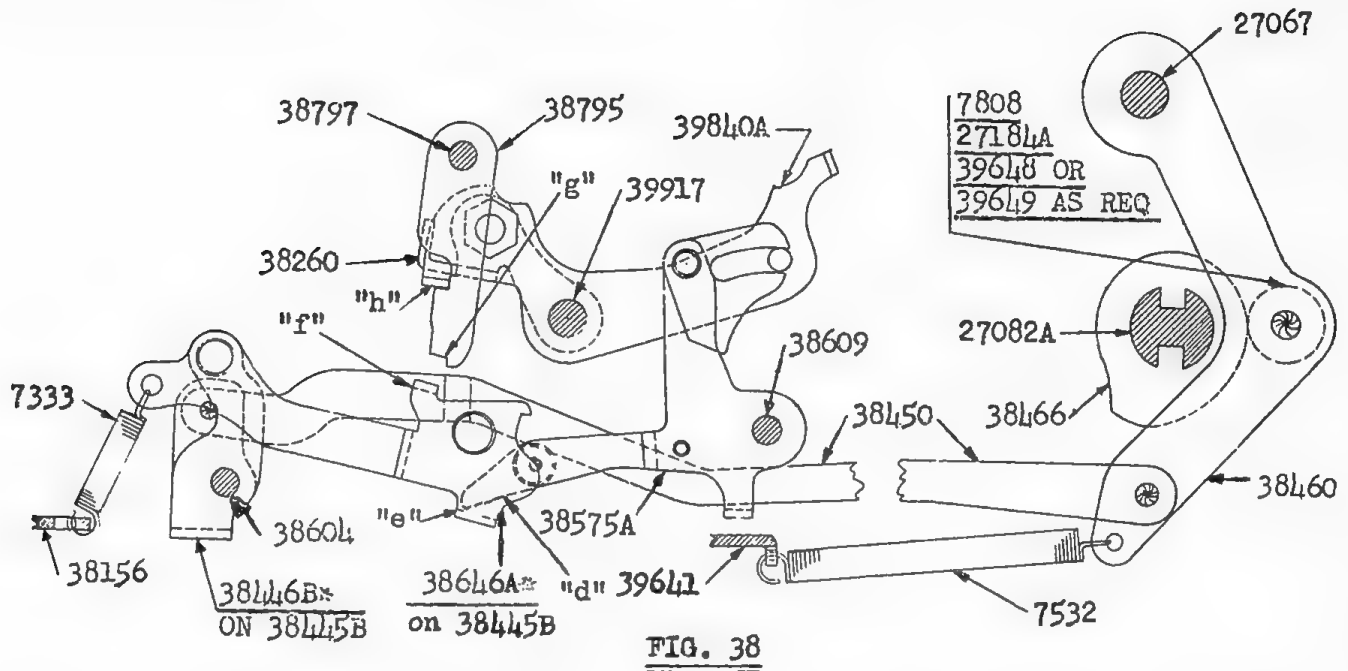
2. (Fig. 37). The Multiplier Starting Bail-39740A, (See Para. B-4 on Pages 1259, 1260 & 1261), has an ear "WW" which rocks the Multiplier Positioning Lever-38575A clockwise by contacting surface "XX" when 39740A is released. Stud-38607* on 38575A contacts surface "YY" on the vertical Shift Direction Link-38850 which now pivots about its upper pivot point. This moves its Stud-38853* out of the notch "ZZ" on the Tab Control Lever-38905, thus breaking the connection from the Tab Keys to the Shift Control mechanism. Stud-38607* is now in a position above surface "a" on 38905, holding 38905 in its Non-Shift position (clockwise) in order to reduce the load on the Tab Control Shaft Bail-38291, (shown on Fig. 76 on Page 1301), when it changes positions in a multiplication shift across the decimal order, during Equals Key operation. The Positioning Lever-38575A is latched by the Positioning Lever Latch-38640.

3. (Fig. 37). When the latching ear "QQ" on 39740A moves rearward it contacts the ear "b" on the Non-Shift Interponent 38576A and rocks 38576A counter-clockwise. Surface "c" on 38576A contacts Stud-38858* on the Shift Selection Link-38855A which in turn holds the Automatic Shift Lever-38951* on 38950, (at least temporarily), in its Non-Shift position.

D. CARRIAGE SHIFT TO LEFTMOST DIGIT ORDER

1. The Shift Direction mechanism must now be positioned for the correct shift direction, (or non-shift), in order to align the carriage with the leftmost multiplier digit. In problems with the leftmost digit more than one order to the left of the decimal point, (such as 000473.9000), the carriage must shift to the right, (two orders in the example); in problems with the leftmost digit in the decimal order (such as 000003.0210) the carriage is

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already in position and no shift is necessary; in problems with the leftmost digit to the right of the decimal point, (such as 000000.3790), the carriage must shift to the left, (one order in the example). Note that this shift always starts from the decimal point.

2. (Fig. 38). These shift direction requirements are sensed through the Multiplier Shift Terminating Bail-38260 which is released for sensing in the early part of the Setting Cycle as follows: the Positioning Lever-38575A has a for-

ward extending arm "d" which goes up when 38575A is carried to its clockwise position. (see Para. C-2 on page 1262). This arm overlies an ear "e" on the Setting Link-38646A* on 38445B which is now allowed to rock counter-clockwise under tension of its Spring 7333 until its ear "f" comes to rest in the notch "g" on the Multiplier Shift Lever Latch-38795. When the Setting Line rotates the Multiplier Setting Cam-38466 moves the Link-38646A* on 38445B rearward through Setting Cam Follower-38460, Setting Link-

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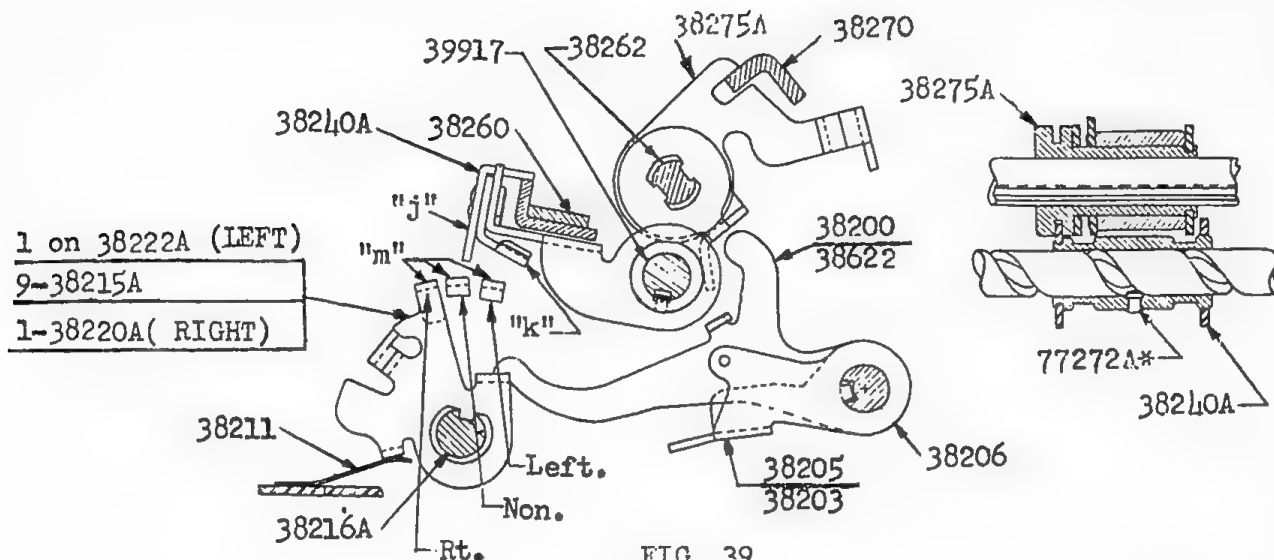


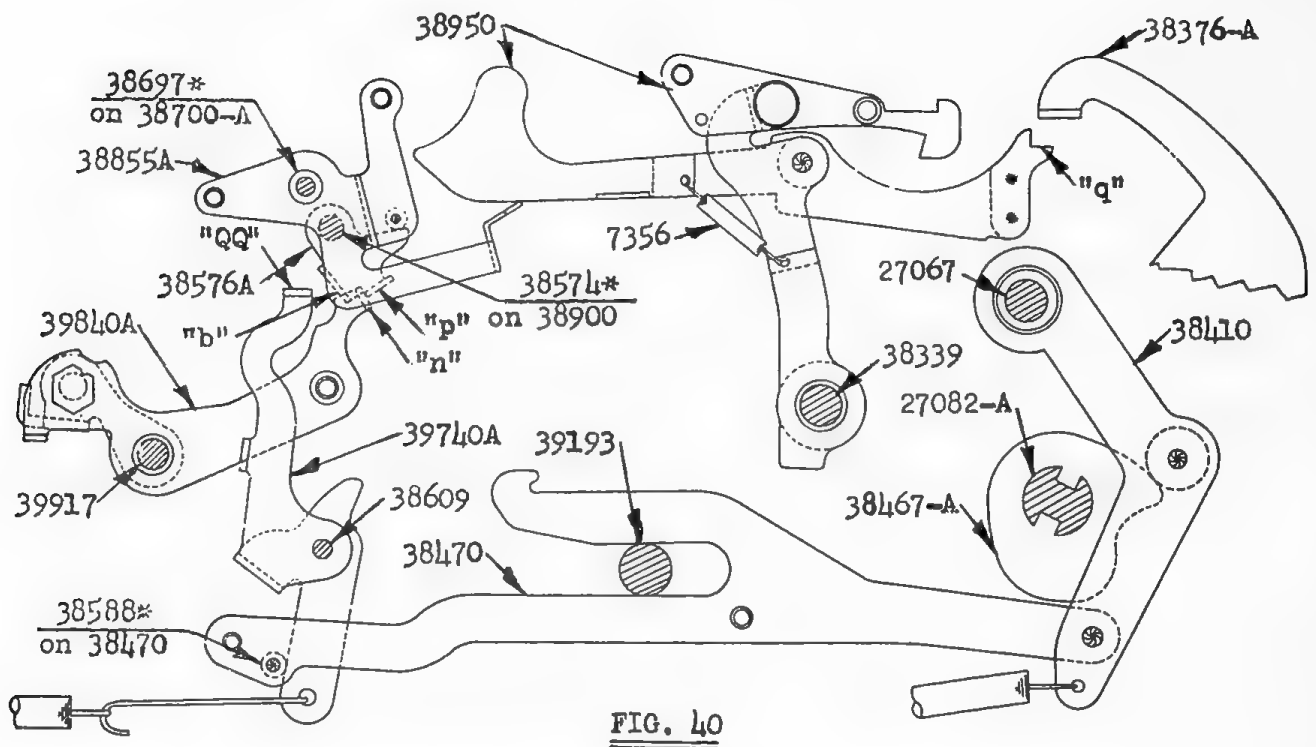
FIG. 39

38450 and Power Bail-38446B* on 38445B, thus rocking the Shift Latch Lever-38795 counter-clockwise. This releases the ear "h" on the Multiplier Shift Lever-3840A and allows the Bail-38260, which is attached to 3840A, to drop.

3. (Fig. 39). Sliding on Bail-38260, and laterally driven in any Shift Cycle by Worm Shaft-39917, is the Multiplier Shift Terminating Arm-38240A, which is a part of an arrangement of laterally movable parts on the Shafts-39917 and 38262, which will be referred to as the

"Traveller". When the Bail-38260 drops, its plates "j" and "k" will or will not stop on an ear "m" on the Lever-38215A in the order to the left of the decimal order, depending on the position of that particular 38215A. If the 38215A in that order is in its "Non-Shift" position, the Arm-38240A will drop only a very small amount until its plate "j" stops on the ear "m". With the 38215A in "Right Shift" position the arm-38240A will miss it entirely and drop all the way; if 38215A is in "Left-Shift" position the Arm-38240A will drop to a position

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about halfway between "Non-Shift" and "Right-Shift" and its surface "k" will stop on ear "m".

4. (Fig. 40). In the case of Non-Shift (multipliers like 000003.0210) the ear "n" on 39840A will therefore rise only a small amount until it comes to a position directly in front of ear "p" on the Non-Shift Interponent-38576A, which has been positioned in "Non-Shift" by the ear "QQ" on 39740A. (See Para. C3 on Page 1262). When 39740A is restored during the Setting Cycle

by Cam-38467A (through Restore Follower-38410 and Stud-38588* on Restore Link-38470) the Interponent-38576A will not be allowed to follow 39740A because it is blocked on ear "n" on 39840A. Thus, the Automatic Shift Lever-38950 will be held in its Non-Shift position through 38855A so that the Drive Lever-38376A misses notch "q" during the last part of the Restore Cycle, and no shift will occur.

5. (Fig. 41). In the case of

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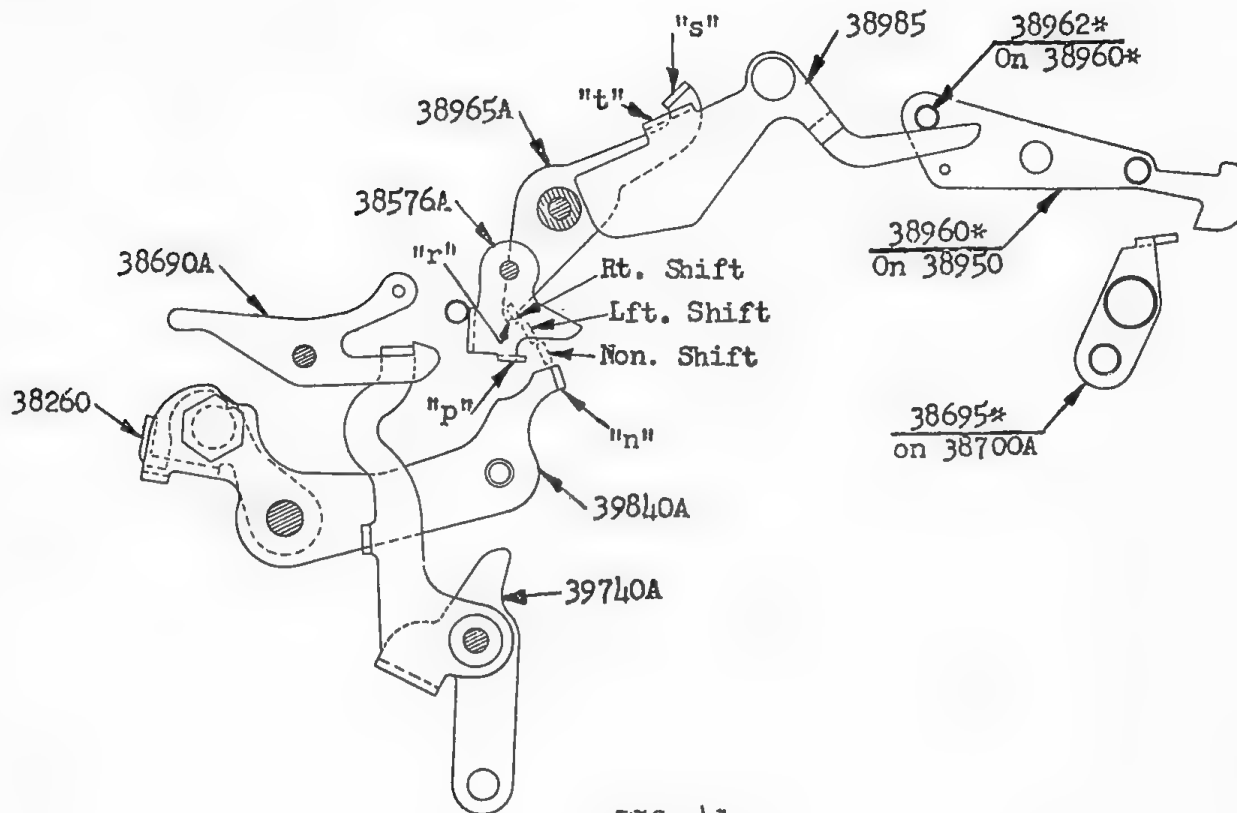


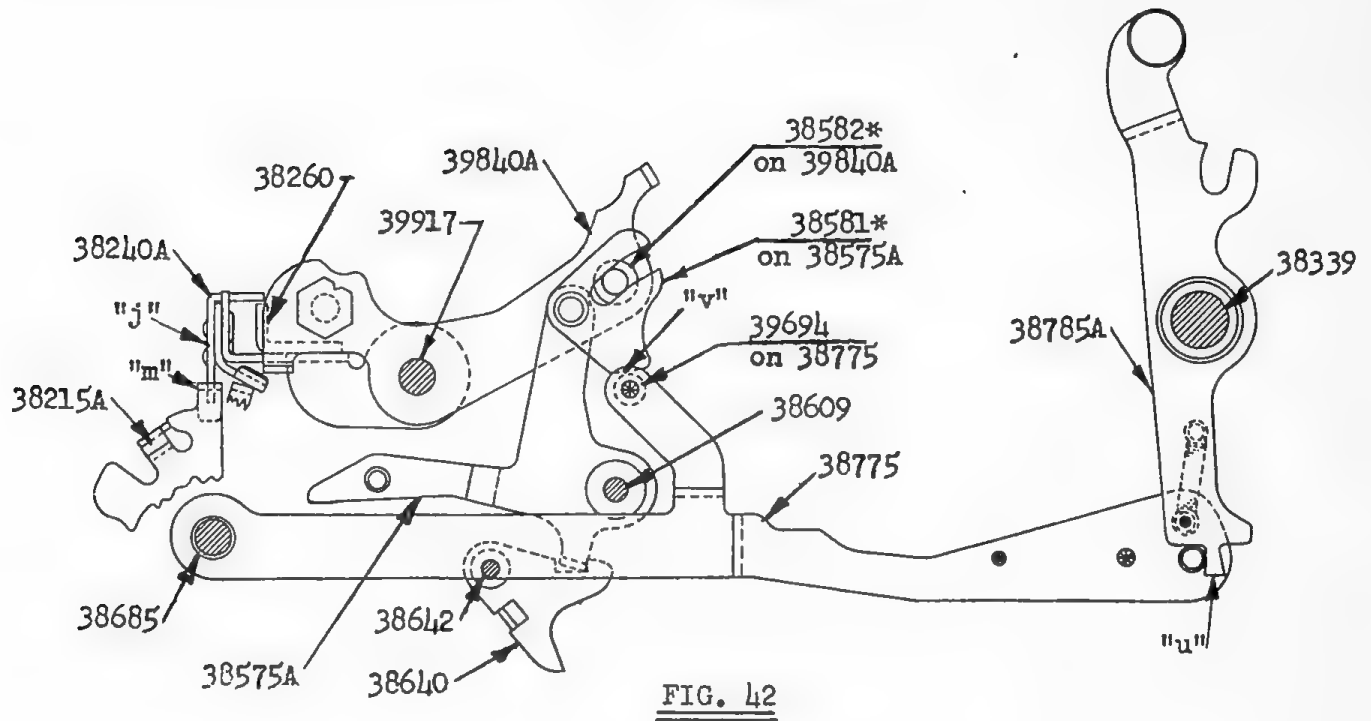
FIG. 41

"Right Shift" the Bail-38260 drops all the way and its Arm-39840A rocks to its full counter-clockwise position. Ear "n" therefore contacts the lower tip "r" of the Right Shift Interponent-38965A and rocks it clockwise; ear "s" on 38965A contacts ear "t" on the Shift Direction Interponent-38985, which, in turn, rocks the Interponent-38960* on 38950 through

Stud-38962* to a Right Shift Position for contact with the Right Shift Lever-38695* on 38700A.

6. (Fig. 41). Normally the Shift Direction Mechanism is conditioned for left shift. When a leftward alignment shift is necessary the Bail-38260 drops to a position halfway between right shift and non-shift, (See Para. D3 on Pages 1264 and 1265), so that ear "n" on Arm-39840A rises high

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enough to allow ear "p" on 38576A to pass under it when 39740-A is restored, but it does not rise high enough to contact the Right Shift Interponent-38965A. The subsequent carriage rise will thus initiate a normal left shift.

7. (Fig.42). When the carriage shifts the Traveller will be driven in the opposite direction by Worm Shaft-39917, the shift being latched by the Shift Latch-38775 engaging the nose "u" on the Shift Latch Control-38785-A. As the

Traveller approaches an Ordinal Lever 38215A in its "Mid", (or "Non-Shift") position (i.e., to the left of the leftmost digit), the plate "j" on 38240A contacts ear "m" on 38215A and is cammed up by it until it comes to rest on top of the ear "m". The Traveller is now considered to be in the Digit Order. This clockwise movement of Bail-38260 and its Arm-39840A lowers Stud-38582* on 39840A which rides in the Shift Terminating Interponent-38581* on 38575A. As the Interponent 38581* swings about its pivot on 38575A its surface "v" wipes across the

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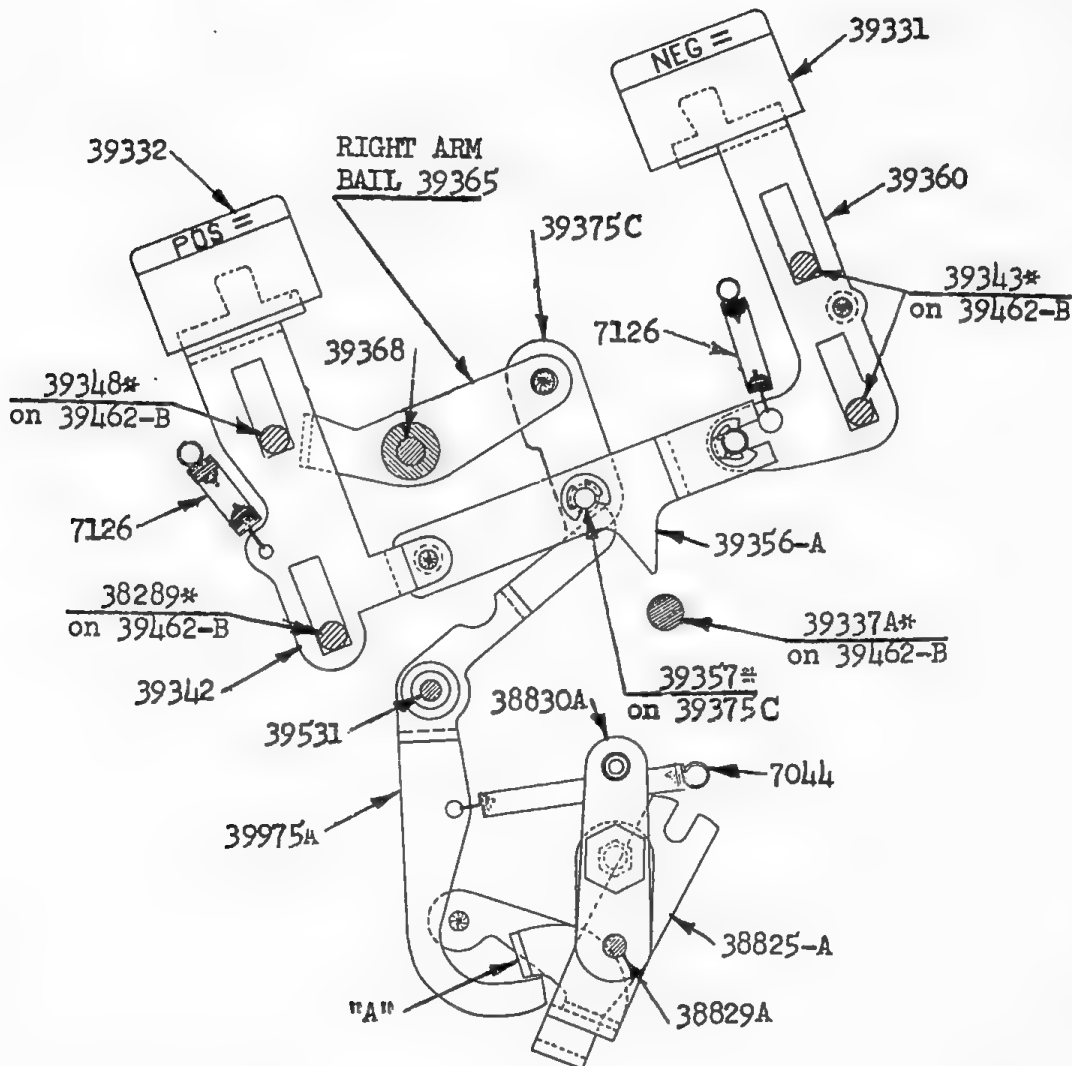


FIG. 43

Roller-39694 on the Shift Latch Lever-38775 and cams it downward, thereby freeing the Shift Latch Control-38785-A for termination of the shift. The machine is now conditioned for entering of the multiplicand and depression of an Equals Key.

VI. EQUALS KEY:

A. Upper Dial and Middle Dial Clearance:

1. (Fig. 43). During the Line-up shift off X-Key or any time thereafter, the multiplicand may be entered into the Keyboard. After the carriage has stopped an Equals Key is depressed to start the actual multiplication pro-

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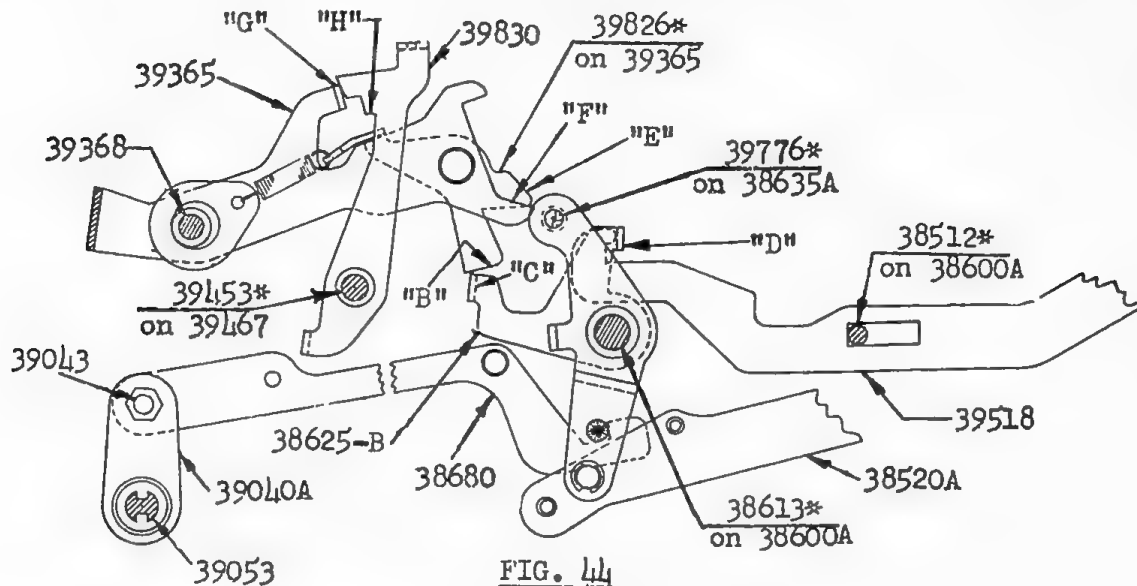


FIG. 44

cess. The Positive (39342) and the Negative (39360) Equals Key Stems are connected by the Equals Key Lever-39356-A in such a manner that the Equals Key Link-39375C, which is attached in the center of 38356-A, is lowered the same amount independent of which Equals Key is depressed. The Link-39375C is attached to the right arm of the Equals Key Bail-39365 and rocks it clockwise.

2. (Fig. 43). In all operations except the Equals operations the Multiplier Transfer Lever 39975A holds the ear "A" on the Transfer Bail-38825-A in its

normal "Zero" position to prevent accidental count of "1" on any other Setting Cycle. This Block-39975A is removed for the Equals operations by Stud-39357* on 39375C rocking 39975A clockwise. The functions of the Bail- 38825-A will be described in forthcoming Para. B-2 on Pages 1272, 1273 and 1274.

3. (Fig. 44). The left arm of Bail- 39365 carries a Live Point-39826* similar to the one on the Multiplier Key Bail-39370. (See Section V-Para. A-3 on Pages 1251 & 1252). Surface "B" on 39826* contacts ear "C" on the Equals Starting Lever 38625B, rocking 38625B counter-clockwise. Ear "D" on 38625B pulls the Master

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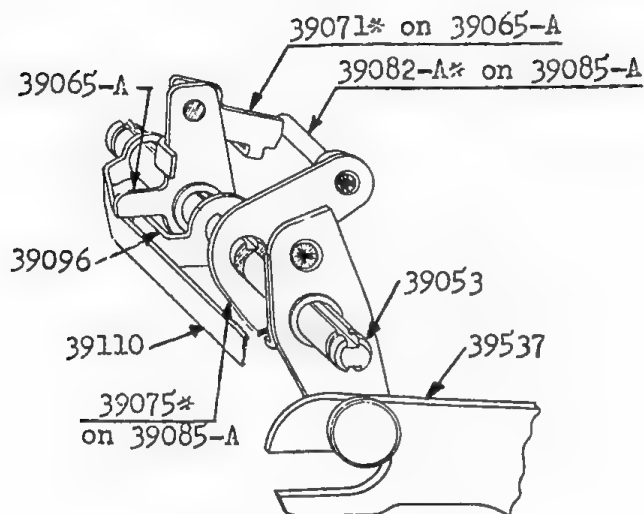


FIG. 45

Clutch Control Link-39518 exactly like the Multiplier Key, (Section V-Para. A-3 on Page 1251), and the Dividend Entry Key. (Section I-Para. B, Page 1208). Rotation of the Master Clutch clears the Upper Dials through Power Link-38520A, Release Lever-38635A, Links-38680 and 39040A, and Shaft-39053, as previously described in Section I-Para. C, Page 1209, if Lock Keys are not depressed. (Clearance of the Middle Dials is practically identical as illustrated in Fig. 45).

4. (Fig. 44). Stud 39776* on the Starting Lever Release Lever-38635A, which rocks counter-clockwise on the Master Clutch Cycle, contacts surface "E" on the Live Point-39826*

and rocks its surface "B" away from ear "C" on 38625A, thus allowing 38625A to return to its normal position and limiting Master Clutch to one cycle. Stud-39776* also contacts surface "F" on Bail-39365, pulling it farther down so that its ear "G" can be latched by surface "H" on Latch-39830.

(Compare Section V-Para. A-5 on Page 1252 for very similar action on the Multiplier Key).

5. (Fig. 46). Para. B-7 on Pages 1276 and 1277 will show that it will be necessary to restart multiplication after every shift in Equals operations. This restart mechanism is also enabled by the Equals Key Bail which has a surface "J" contacting Stud-39393* on the Multiply Delay Lever-39395 and rocking it counter-clockwise. Surface "K" on 39395 rocks the Restart Lever 38670 clockwise through ear "L" on 38670; Stud-38672* on 38670 allows the Restart Inter-ponent 38766A* on 38730A to rock

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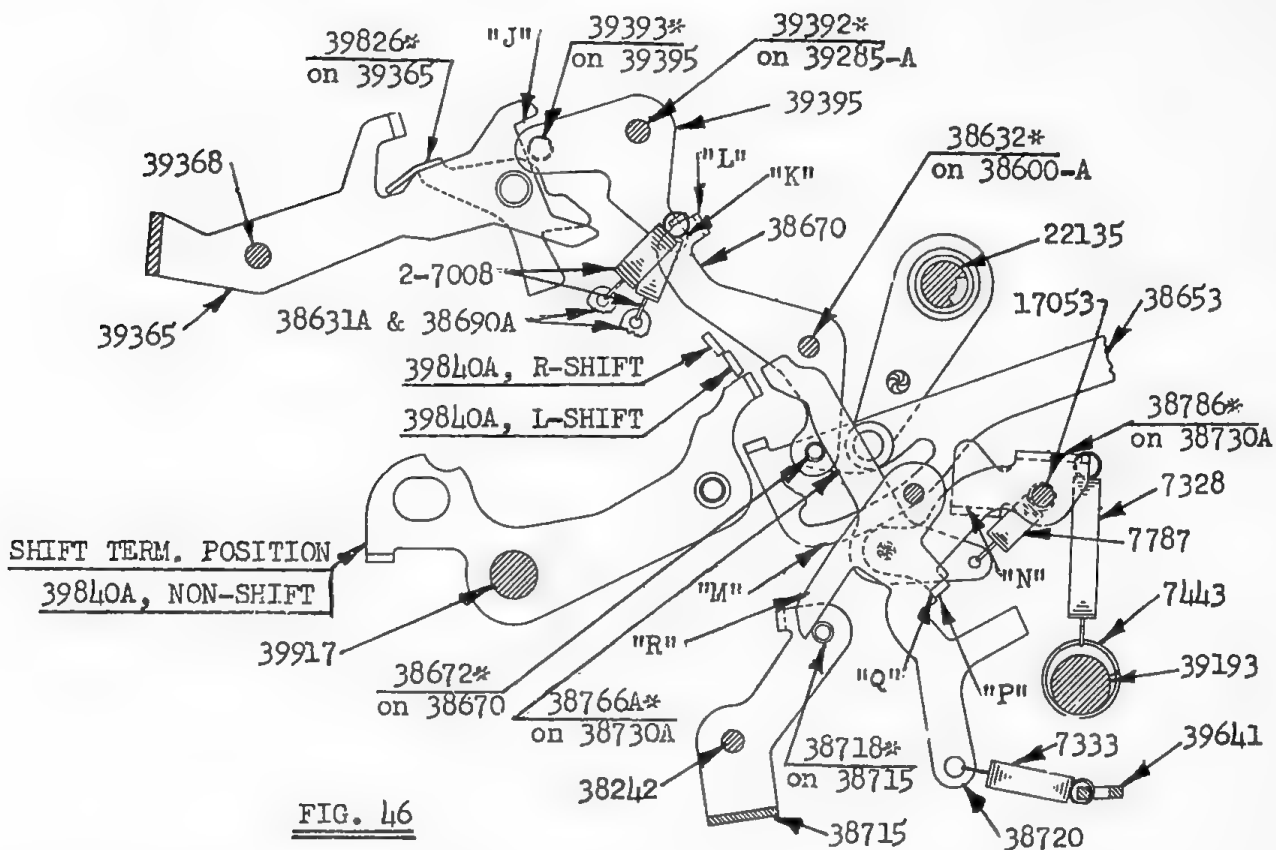


FIG. 46

counter-clockwise and thereby to come under control of the Multiplier Shift Lever-39840A.

6. (Fig. 46). The first Setting Cycle on Equals Key operations is initiated by the Master Clutch Cycle as follows: When Power Link-38653 moves rearward on the Master Clutch Cycle, (Section I-Para. D, Page 1211), its surface "M" contacts ear "N" on the Restart Latch-38786* on 38730A, thereby rocking 38786* counter-clockwise. This moves ear "P" on 38786* out

of notch "Q" on the Restart Yield Lever-38720 so that 38720 can rock counter-clockwise under tension of its Spring 7333. Arm "R" on 38720 contacts Stud-38718* on the Setting Cycle Opening Bail and rocks it clockwise, thus opening the Setting Clutch for an active cycle as described in Section III-Para. A, Page 1244.

B. SEQUENCE OF MULTIPLICATION:

1. (Fig. 47). During the Setting Cycle on X-Key operation the Set-



2. (Fig. 48). The forward extending arm of 38729A carries a Stud-38818* which goes through a slot in the Multiplier Sensing Yield Lever-38791 and which is connected to the upper ear on 38791 by Clip-38793 and two Springs-7485, so that counter-clockwise movement of 38729A yieldably pulls 38791 down. The lower end of 38791 is connected to the Multiplier Transfer Bail-38825A and rocks it counter-clockwise. Slot "U" on the left arm of 38825A embraces a Stud-38372* on the right arm of the Multi-

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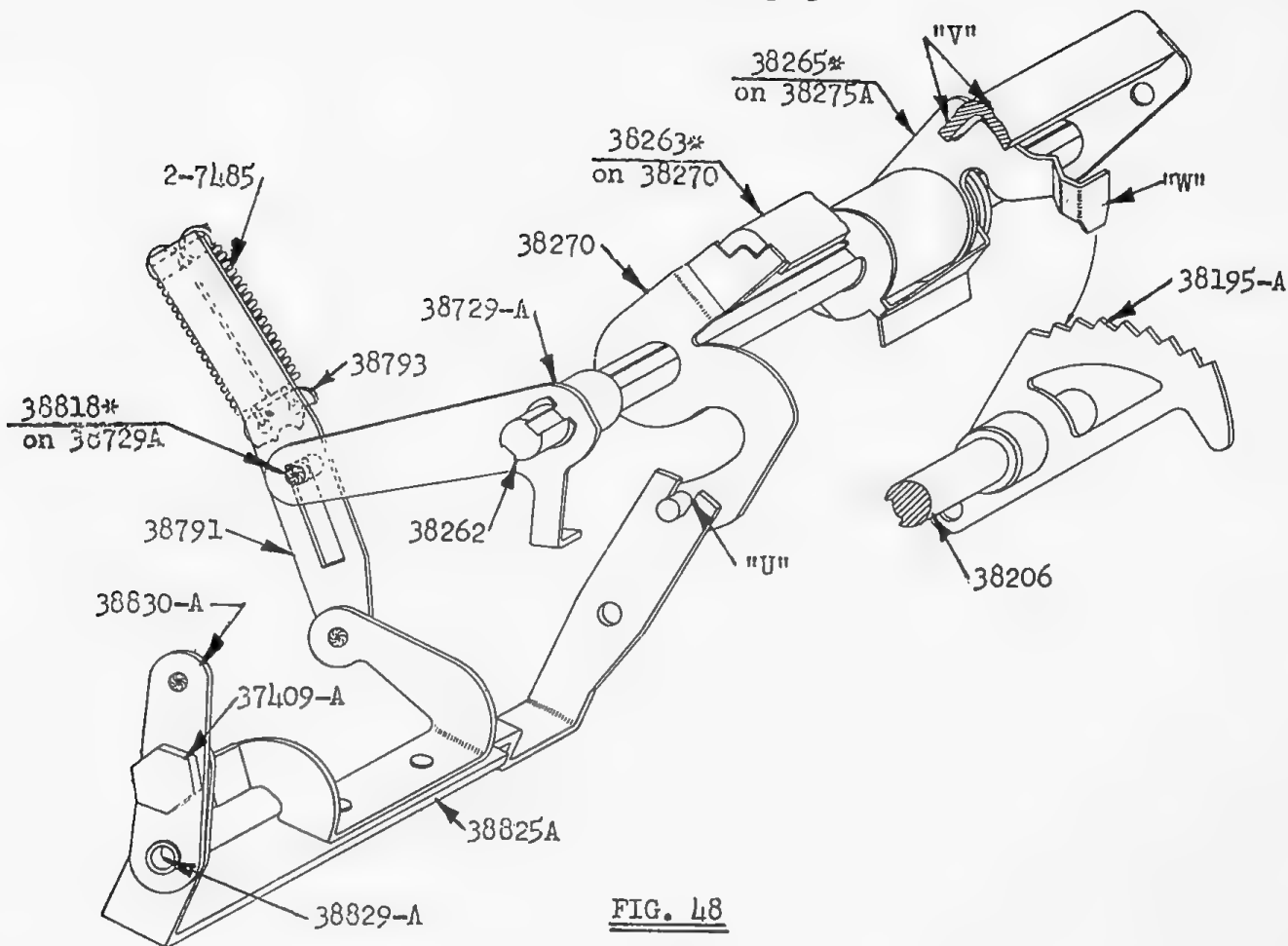


FIG. 48

plier Sensing Bail-38270 so that the Bail-38270 is dipped by the movement of the Transfer Bail-38825A. Riding on Shaft-38262 and guided by surface "V" on the Bail-38263* on 38270 is the the Blocking Release Lever Assembly-38275A, which forms a part of the "Traveller" described and illustrated in Section V-Para. D-3 on Page 1264. It has been described in Section V-Para. D-7 on Pages 1267 and 1268 that the X-Key

shift brings the Traveller into the leftmost digit order and in line with the Step Cam-38195A which is in a position representing the multiplier digit in that order. (Section V-Para. A-10, Page 1255). Bail 38270 therefore dips until the ear "W" on the Sensing Arm-38265* on the Traveller comes to rest on a step of the Step Cam-38195A. This positions the Transfer

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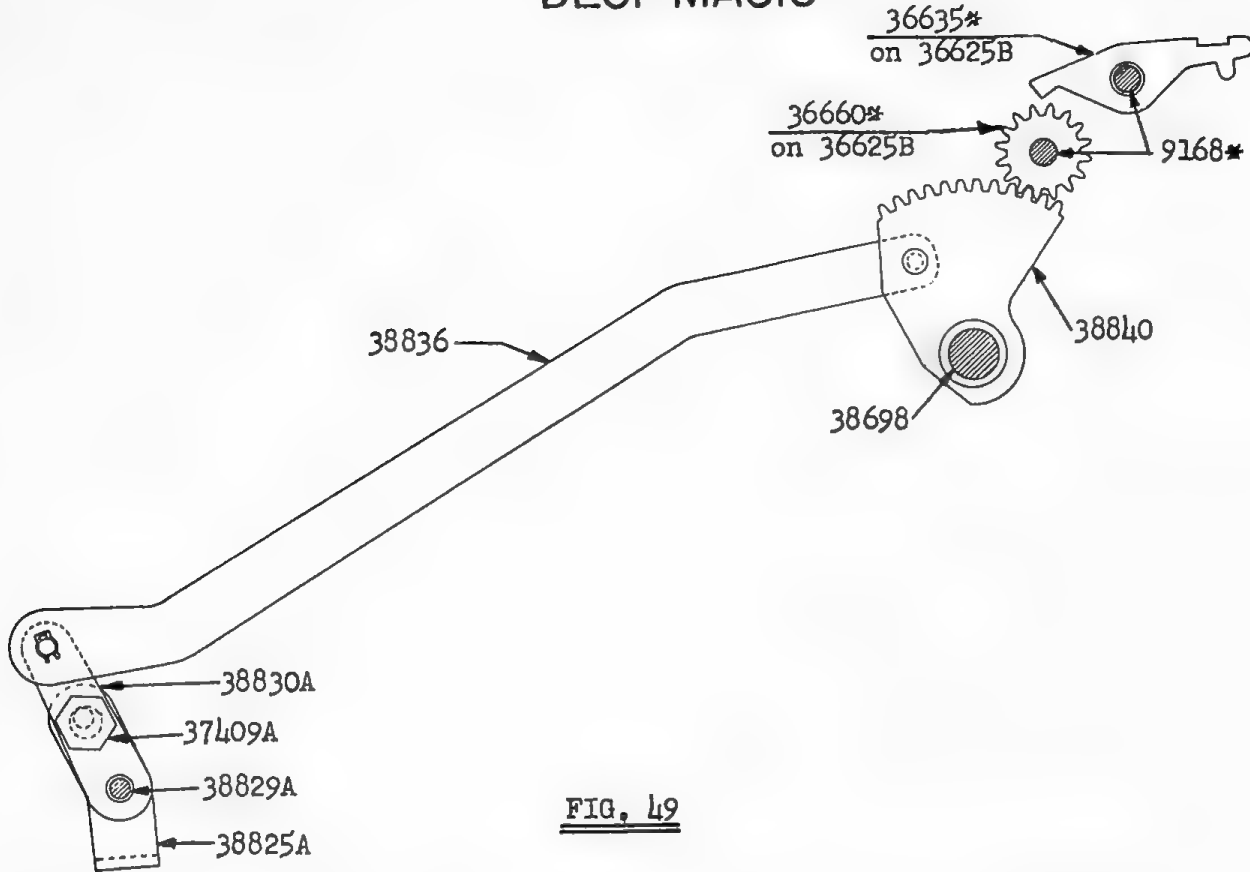


FIG. 49

Bail-38825A in accordance with the digit, (#8 in Fig. 48), in the leftmost digit order.

3. (Fig. 49). Connected to the right arm of Transfer Bail-38825A by Eccentric-37409A is an Adjustment Arm-38830A which connects to the Multiplier Selection Segment-38840 through Link-38836, thus positioning the Multiplier Trip Unit-36625B. Operation of the Pawl-36635* and Multiplier Count-out is continued in the stand-

ard manner from the Setting Clutch operation.

4. (Fig. 50). Lever 38729-A, (Fig. 48), is tightly keyed to Shaft-38262 and rocks it counter-clockwise on the Setting Cycle. Also, fully keyed to Shaft-38262, (but laterally movable on it), is the Blocking Release Lever-39678* on 38275A which forms a part of the Traveller. When 39678* is rocked by Shaft-38262 its ear "X" contacts the surface "Y"

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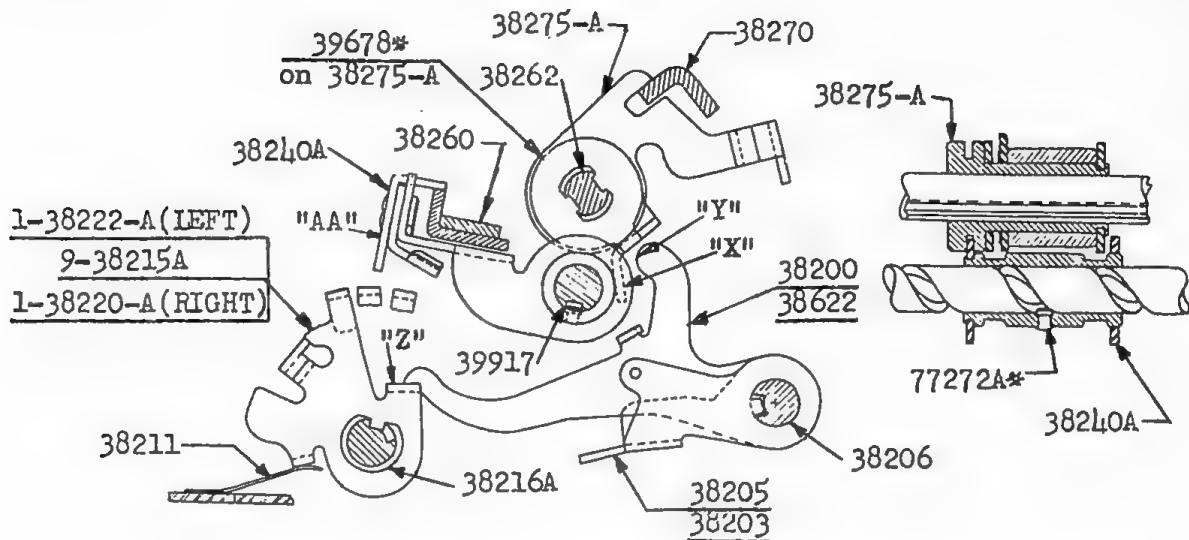


FIG. 50

on the Blocking Lever-38200 and rocks it clockwise, thereby removing the forward extending latching surface on 38200 from ear "Z" on 38215A.

5. (Figs. 50 & 51). In order to allow the now unlatched ordinal member-38215A to fall back to its "Zero" position it is necessary to lift the Bail-38260 to eliminate the friction between plate "AA" and the upper ear on 38215A in the order adjacent to the left. This is accomplished by the Bail Lifter Driver-38845 which is tightly keyed to the right end of Shaft-38262,

and which rocks counter-clockwise on the Setting Cycle. Its ear "BB" then contacts surface "CC" on the Bail Lifter-38748C and rocks it clockwise, thereby lifting the Traveller-38240A clear of the ear on 38215A through Bail-38260. This allows the 38215A in that order to spring to its "Zero" position, and all 38215A's to the right of it up to (but not including) the one to the left of the next digit to follow and spring to their "Zero" positions. When the Traveller is allowed to drop again later in the Setting

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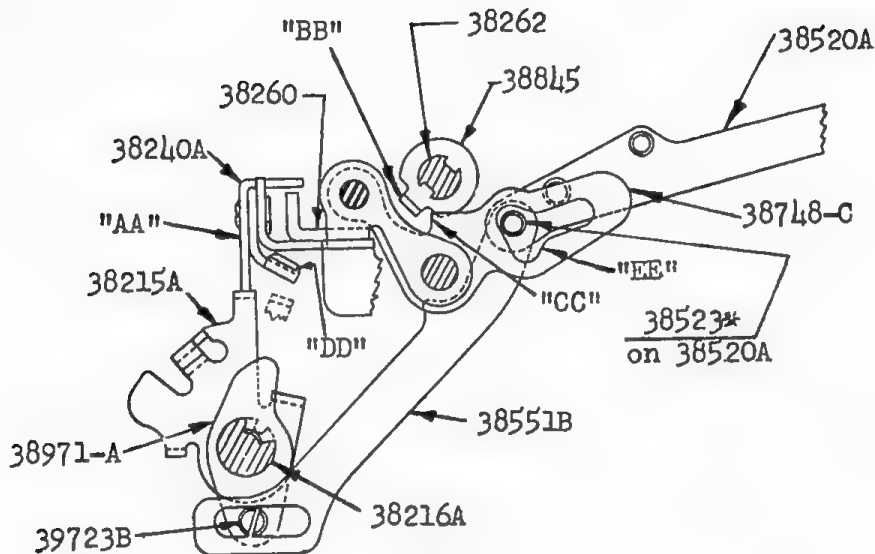


FIG. 51

Cycle, its ear "DD" stops on the 38215A, (which is now in its "Zero" position), and thus positions the Shift Direction mechanism, (Section V-Para. D-6, page 1266), for left shift.

6. (Fig. 51). It should be noted here that Bail-38260 is also lifted on every Master Clutch Cycle in order to avoid damage to the mechanism in case the Bail-38260 has accidentally been released and its plate "AA" rests in front of the 38215A's at a time when the 38215A's are rocked by the Master Clutch

Cycle. When Link-38520A moves rearward on the Master Clutch Cycle, (Section I-Para. C-1, Page 1209), its Stud-38523* contacts surface "EE" on the Bail Lifter-38748C, rocking it clockwise and lifting the Bail-38260 in the same manner as described in the preceding paragraph.

7. (Fig. 52). When the carriage shifts to the left the Traveller moves to the right until it is cammed up on the next 38215A in "Mid" position. This terminates the shift in the same manner as described in Section V-Para. D-7, Page 1267

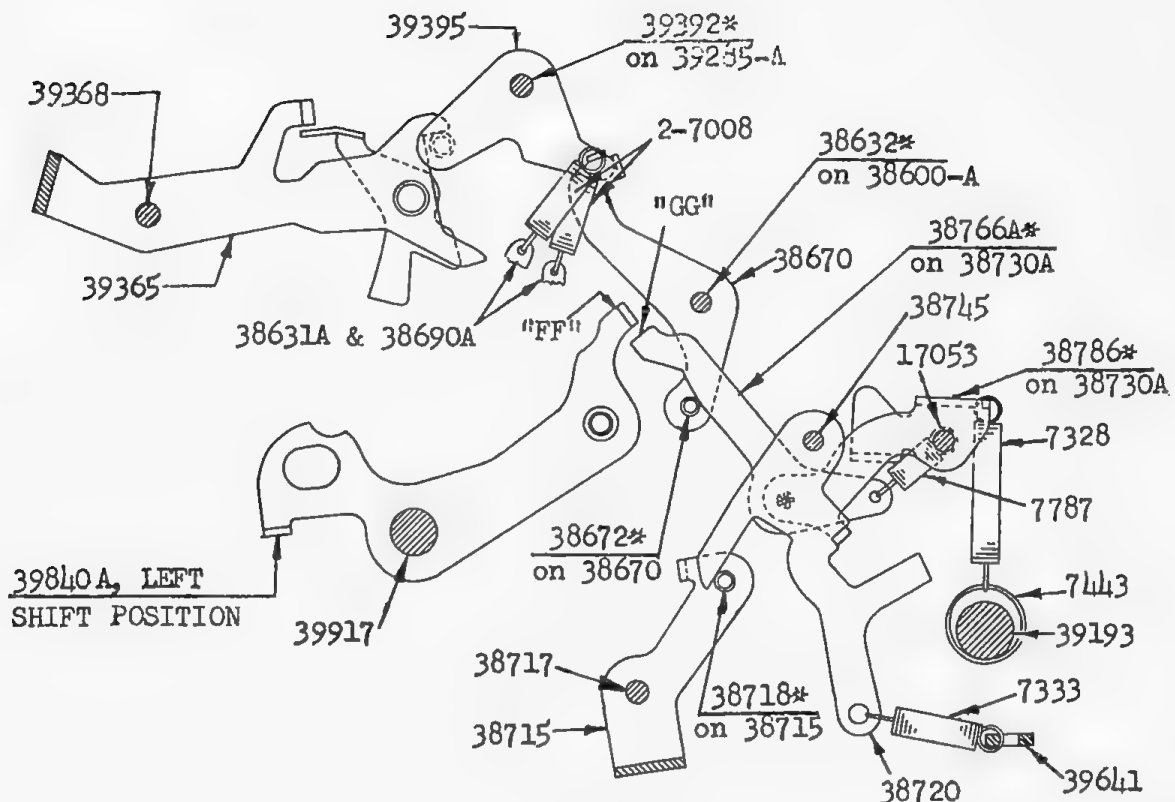


FIG. 52

The same movement of Lever-39840A that terminates the shift causes Ear "FF" on 39840A to push the Restart Interponent-38766A* downward through surface "GG", thereby rocking the Restart Latch-38786* counter-clockwise. This releases the Restart Yield Lever-38720 in the same manner described in Section VI-Para. A-6, Page 1271, opening the Setting Clutch for an active cycle. 8.(Fig. 53). During the restore

phase of the Setting Cycle the Restart Yield Lever-38720 is restored so that notch "Q" on 38720 can be latched up again by ear "P" on 38786*. As Restore Link-38470 moves rearward on the second part of the Setting Cycle its Stud-38899* contacts surface "HH" on the Recoil Bail-38765, rocking it counter-clockwise, thereby restoring 38720 clockwise through Stud-38767*.

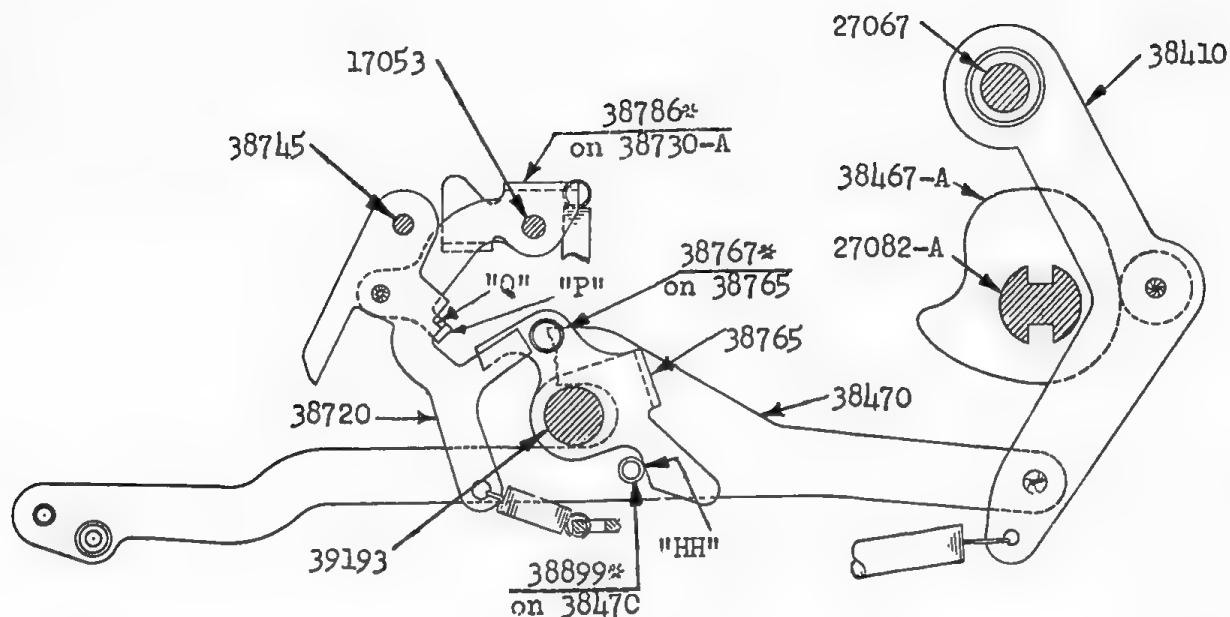


FIG. 53

C. TERMINATION OF MULTIPLICATION:

1. (Fig. 54). It has been mentioned in Section V-Para. B-5, page 1261, that

rocking of the Multiplier Starting Bail-39740A puts the last restore Mechanism under control of the Multiplier mechanism; when 39740A rocks clockwise its

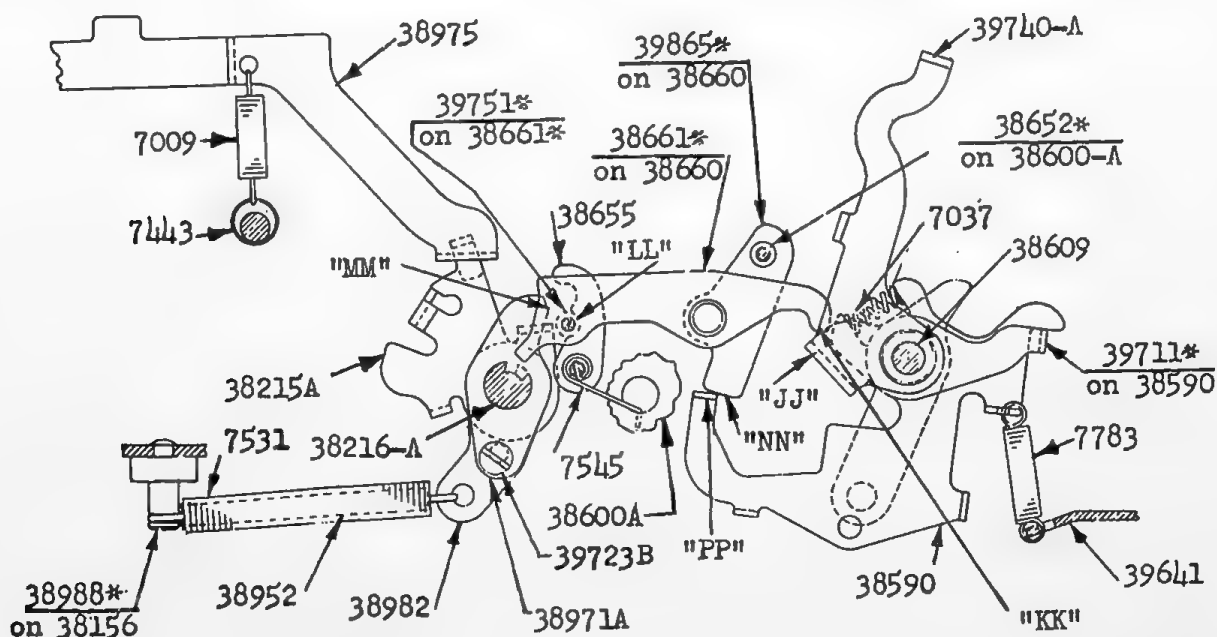


FIG. 54

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shelf "JJ" contacts the rearward extending nose "KK" on the Multiplier Stop Interponent-38661* and rocks it counter-clockwise so that its Stud-39751* comes to rest in the lower notch "LL" of the Detent-38655. This takes the Interponent-38661* out of the path of the Front Dial Clear Link-38975 and brings it under control of the Levers-38971A which are tightly keyed to Shaft-38216A.

2. (Fig. 54). As long as one or more ordinal Levers-38215A are latched forward their keys hold the Shaft-38216A in such a position that the twin Levers-38971A are clear of Stud-39751* on 38661*. As soon as the last multiplier digit is counted out and the last 38215A is

unlatched, the Shaft-38216-A rocks clockwise under the tension of Spring-7531. A stop for Shaft-38216A in its rearward position has been provided in the following manner: The Spring Arm-38982 is keyed on Shaft-38216A and is assembled to the Levers-38971A and comes to rest against the Stop-38952 and Stud-38988* on the Bottom Frame-38156, thus stopping the movement of Shaft-38216A. The tip "MM" on 38971A now rocks the Multiplier Terminating Latch Assembly-38660 rearward and counter-clockwise through Stud-39751*. This removes surface "NN" on 39865* from ear "PP" on the Multiplier Terminating Lever-38590, thereby allowing the Lever-38590 to rock clockwise under tension of its Spring-7783.

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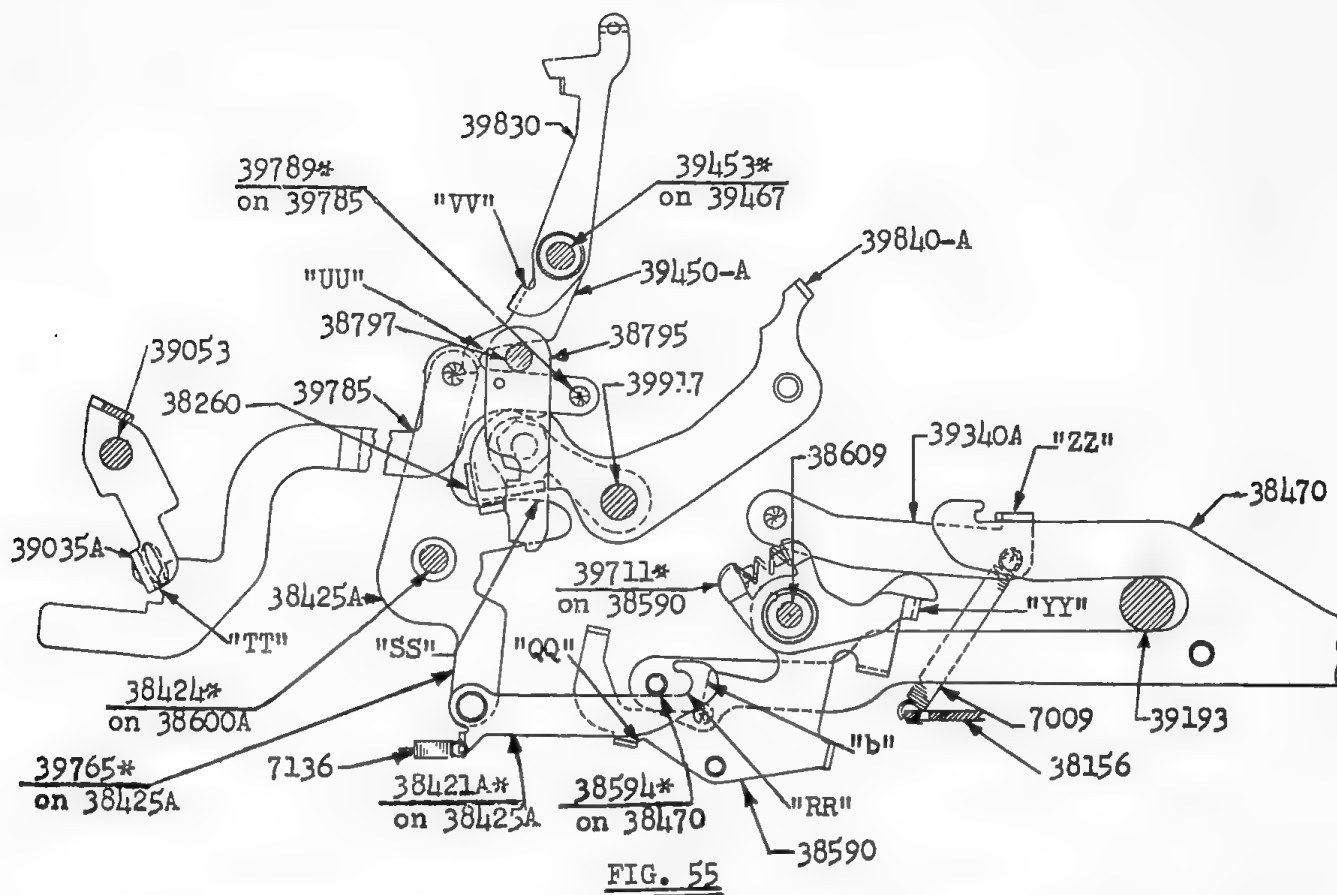


FIG. 55

3. (Fig. 55 & 56). When the Multiplier Terminating Lever-38590 is released to rock clockwise it converts the normal restore cycle into what will be termed a "Last Restore" operation. Ear "QQ" on 38590 rocks the Link-38421A* upwards so that the hook "RR" on 38421A* can be picked up by Stud-38594* on the Restore Link-38470 when 38470 moves rearward as in any other restore cycle. The Multiplier Restore Lever-38425A therefore rocks

counter-clockwise in the last Restore cycle and performs the following functions:

- a. (Fig. 55). Its surface "SS" underlies the Shift Terminating Bail-38260 and restores it clockwise so that its Arm-39840A can be latched up by 38795.
- b. (Fig. 55). Connected to the upper end of 38425A is the Keyboard Clear Restore Link-39785 which is moved forward so that its surface "TT"

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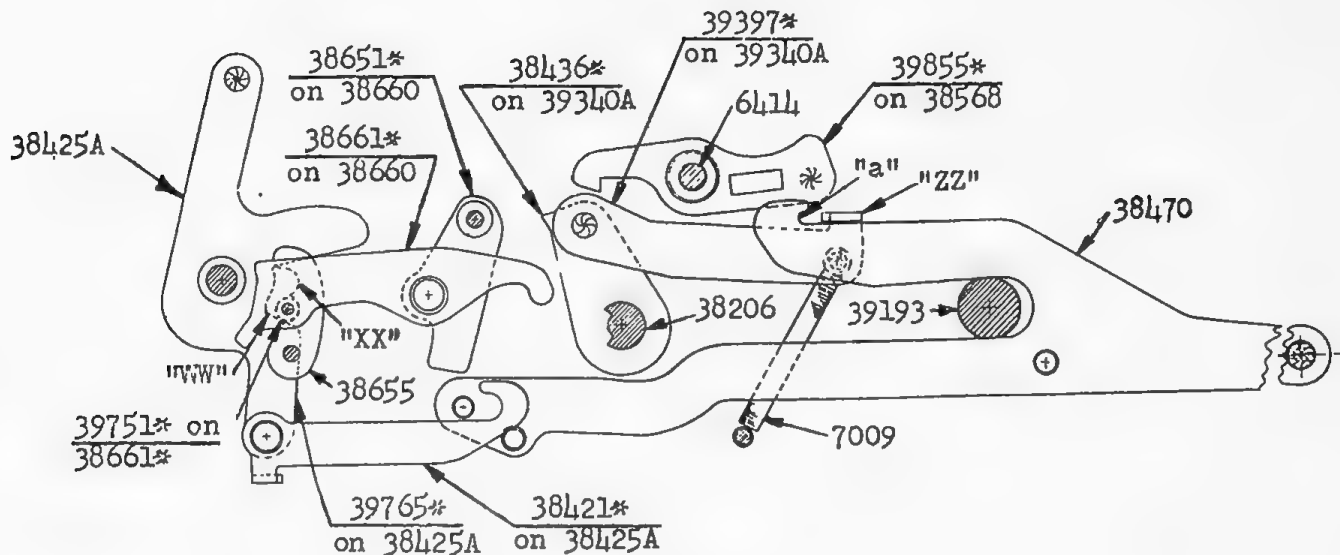


FIG. 56

rocks the Keyboard Clear Bail-

39035A clockwise, thereby clearing

the Keyboard selectively in the

same manner as the Add Key. (Sec-

tion III-Para. C, Page 1245).

c. (Fig. 55). Stud 39789* on 39785

contacts the tail "UU" on the Mult-

plier Bail Latch-39450A, rocking

it clockwise and thereby unlatching

the X-Key and its Bail-39370. (Sec-

tion V-Para. A-1, Page 1248). This

also rocks the Equals Key Bail Latch-

39830, which has an ear "VV" overly-

ing 39450A, so that the Equals Key

and its Bail-39365 are also released.

(Section VI-Para. A-4 on Page 1270).

The return of 39365 allows 38670,

(Fig. 52 on Page 1277), to rock

counter-clockwise (Spring-7008)

removing 38766A* from under 39840A.

d. (Fig. 56). Surface "WW" on

38425A contacts Stud-39751* on the

Stop Interponent-38661* and rocks

it up into the upper notch "XX" on

the Detent-38655 in order to re-

turn the Last Restore mechanism

to the control of the

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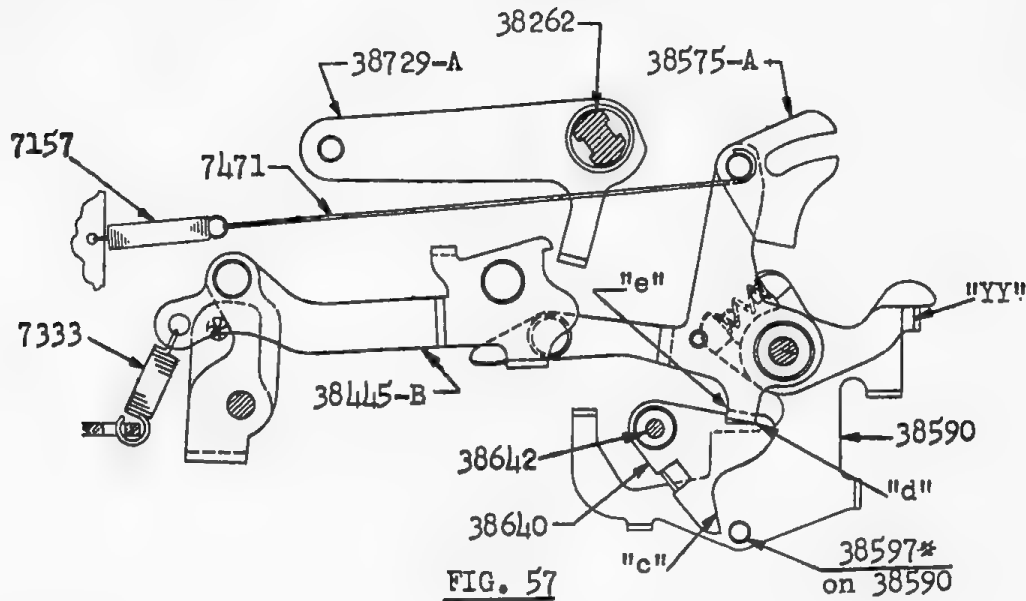


FIG. 57

Front Dial Clear Key (Section X-Para. B, page 1290).

4. (Fig. 55 and 56). When 38590 rocks clockwise, ear "YY" on its Live Point-39711* moves down and thereby allows the Selection re-store link-39340A to drop until ear "ZZ" on 39340A stops on re-store Link-38470, (Fig. 55). When Link-38470 subsequently moves rearward, its hook "a", (Fig. 56), catches ear "ZZ" on 39340A and pulls it rearward, thereby restoring Shaft-38206 through the twin Lever-38436* to a point where they can again be latched up by Latch-39855* on 38568. This clears

the Front Dials as can be seen from Section V-Para. A-10, page 1255.

5. (Fig. 55). Stud-38594* on 38470 also restores 38590 through surface "b" back to its normal latched position.

6. (Fig. 57). In order to return the carriage to its normal decimal position to point out the answer in the Product Dials, the Shift Direction mechanism must be brought back to tab control. When the Terminating Lever-38590 rocks clockwise its Stud-38597* contacts surface "c" on the Positioning Lever Latch-38640 and rocks it clockwise,

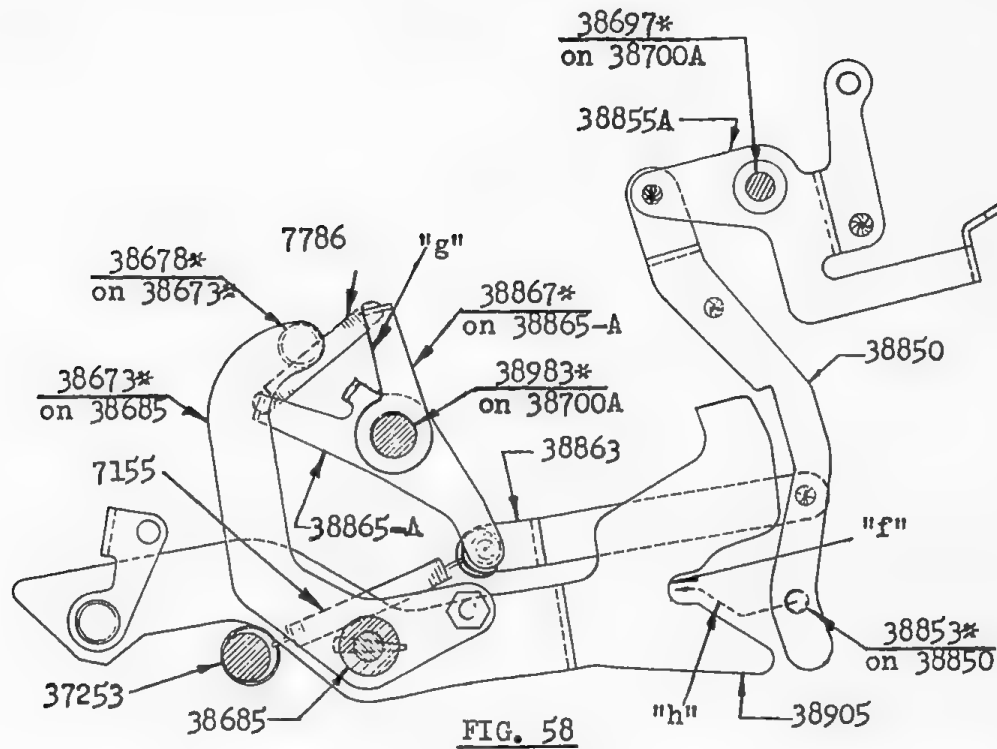


FIG. 58

thereby removing surface "d" on 38640 from behind ear "e" on 38575A and allowing 38575A to return to its normal position under tension of its Spring-7157.

7. (Fig. 58). It has been described in Section V-Para. C-2, page 1262, that 38575A rocks the vertical Shift Direction Link-38850 through Stud-38607* on 38575A. With 38575A back at its normal position, Lever-38905 can now rotate counter-clockwise to stop on the Roller on the Tab Bail and Link-38850 can now be brought back into the notch "f" on the

Tab Control Lever-38905. On the restore portion of the Setting Cycle the Pinning-38685 is rocked clockwise, (Section III-Para. B-1, page 1244), so that the Arm-38673* and its Stud-38678* contact surface "g" on Arm-38867* on the Shift Re-engage Lever-38865A. This rocks 38865A clockwise through Yield Spring-7786, thereby pulling the vertical Link-38850 into engagement with 38905 through Re-engage Link-38863. Stud-38853* on 38850 follows a path "h", thereby position-

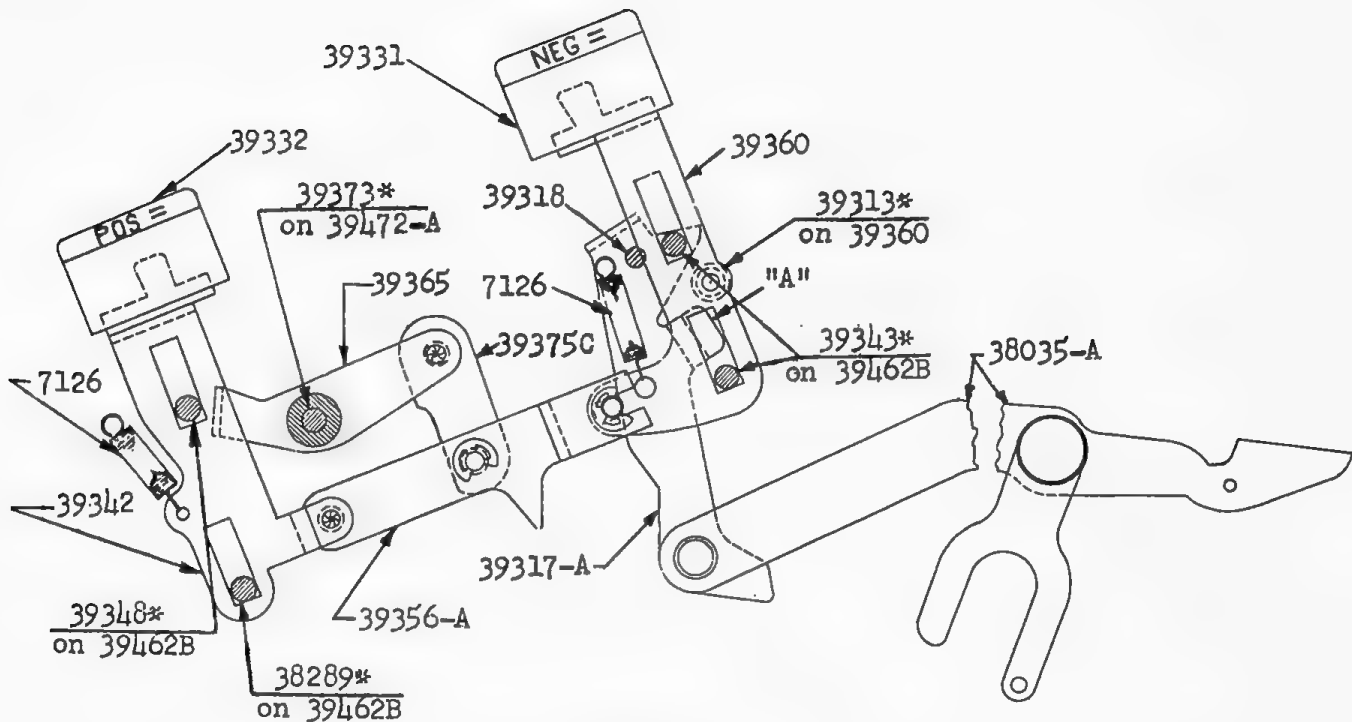


FIG. 59

ing the Shift Selection Link-38855A in accordance with the position of 38905. The shift is then initiated in the usual manner in the restore cycle for a return to the decimal position. (See Section XIX-Para. A-2 on Page 1302).

VII. NEGATIVE EQUALS KEY:

1. (Fig. 59). The Negative Equals Key performs exactly the same functions as the Positive Equals Key except that the answer is

subtracted from the Product Dials rather than added. The Negative Equals Key Stem-39360 carries a Roller-39313* which contacts surface "A" on the Reverse Setting Bail-39317A, rocking it clockwise and moving the Reverse Setting Bar-38035A forward. This reverses the rotation of the Actuator in the standard manner.

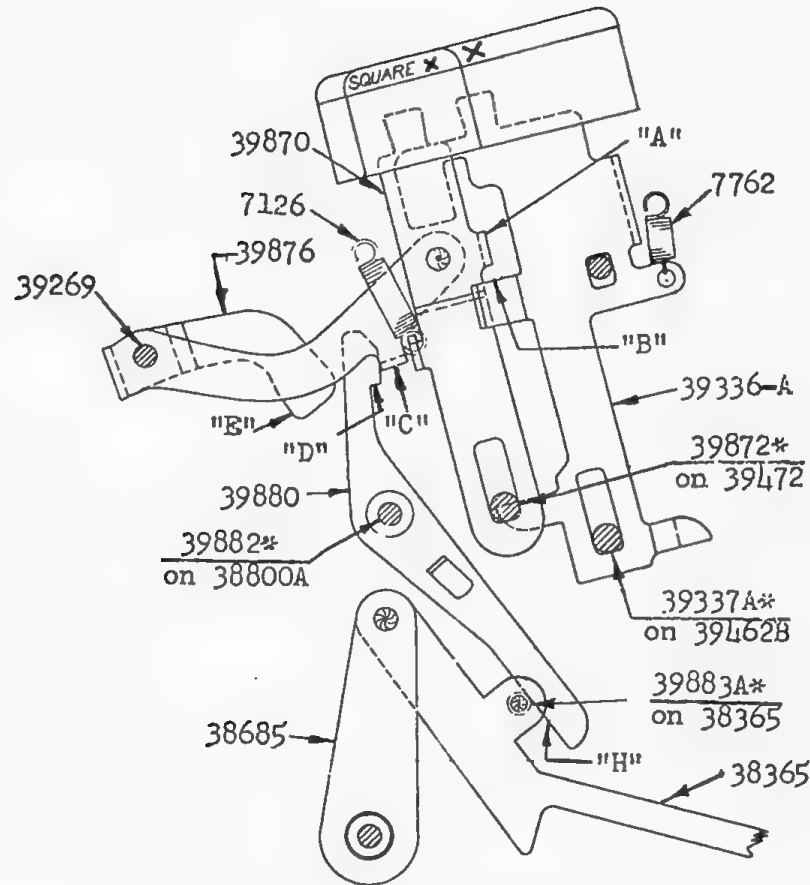


FIG. 60

VIII. SQUARE-X-KEY:

1. (Fig. 60). Depression of the Square-X-Key results in an X-Key operation without Keyboard clearance in order to allow multiplication of a number by itself without having to enter the same number twice. The Square-X-Key Stem-39870 has an ear "A" which overlies an ear "B" on the X-Key Stem-39336A, carrying the X-Key down and

starting the normal X-Key operation.

39870 also rocks the Square-X-Bail 39876 clockwise to where ear "C" on 39876 can be latched by step "D" on the Square Key Latch-39880.

2. (Fig. 60 & 61). The surface "E" on the left arm of Bail-39876 contacts ear "F" on the Live Point-39861* on the Keyboard Clear Bail-38280, rocks the Live Point-39861* clockwise, and thereby moves its ear

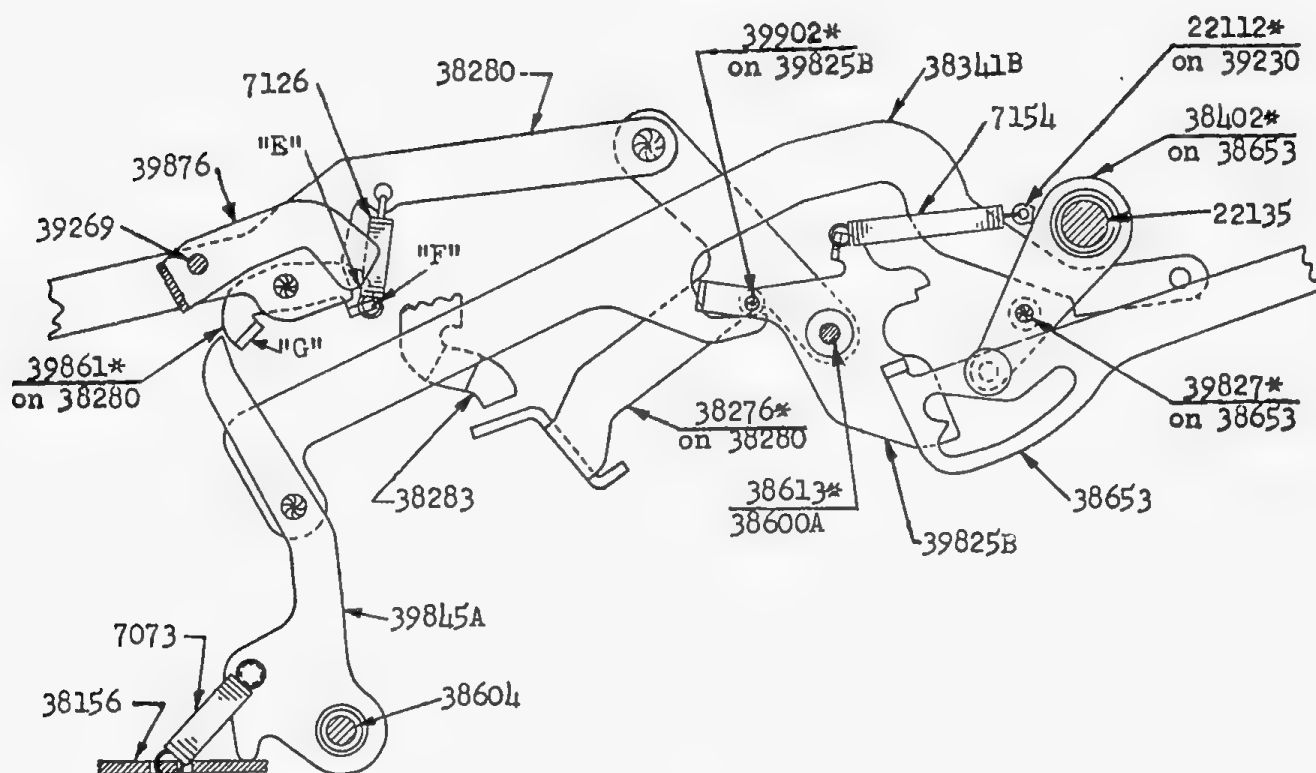


FIG. 61

"G" out of the path of the Keyboard Clear Lever-39845A. When Link-38653 moves rearward on the Master Clutch Cycle, (See Section V-Para. A-11, page 1257), to clear the Keyboard, 39845A will miss the Live Point and the Keyboard clearance will not take place.

3. (Fig. 60). During the setting cycle on X-Key operation the Link-38365 moves rearward so that its Stud-39883A* rocks Latch-39880

counter-clockwise through surface "H" on 39880, thereby releasing the Square-X-Key to return to its normal position.

IX. FRONT DIAL LOCK KEY:

1. (Fig. 62). If a figure in the Front Dials is to be maintained as a constant multiplier the Front Dial Lock Key may be depressed before or during multiplication at any time prior to

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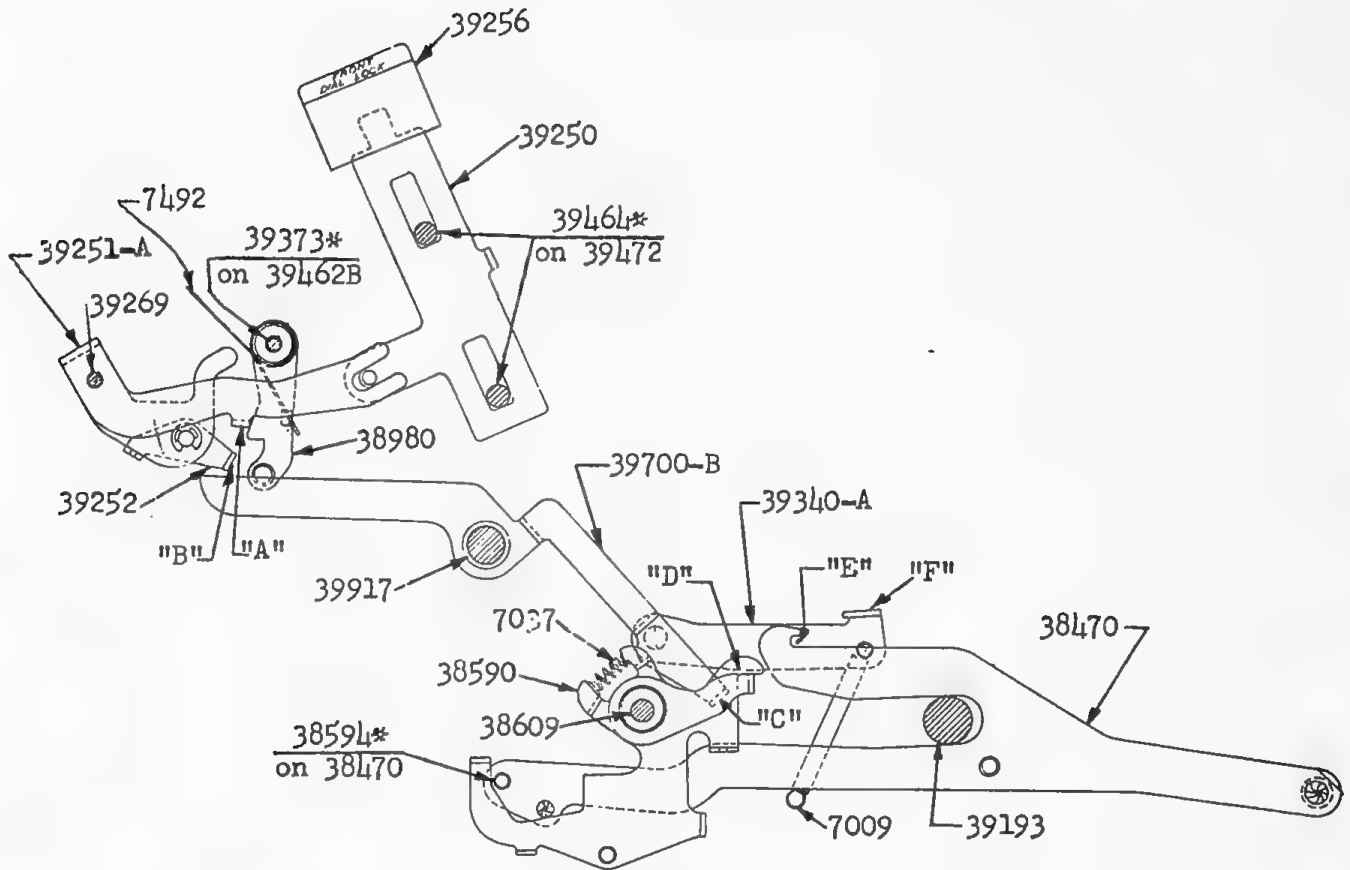


FIG. 62

the last Restore Cycle. Depression of the Front Dial Lock Key Stem-39250 rocks the Front Dial Lock Bail-39251A clockwise to a point where the ear "A" on 39251A can be latched by Latch-38980. The left arm of Bail-39251A carries a Live Point-39252 with an ear "B" which rocks the Selection Restore disabling Lever-39700B counter-clockwise. This brings ear "C"

on 39700B into contact with surface "D" on the restore Link-39340A so that 39340A maintains its position when 38590 is released to give a Last Restore Cycle. (See Section VI- under C on Page 1278). Hook "E" on 38470 will therefore miss ear "F" on 39340A, and Multiplier Selection Shaft-38206 will not be restored, leaving the Multiplier value in the storage mechanism and in the Front Dials.

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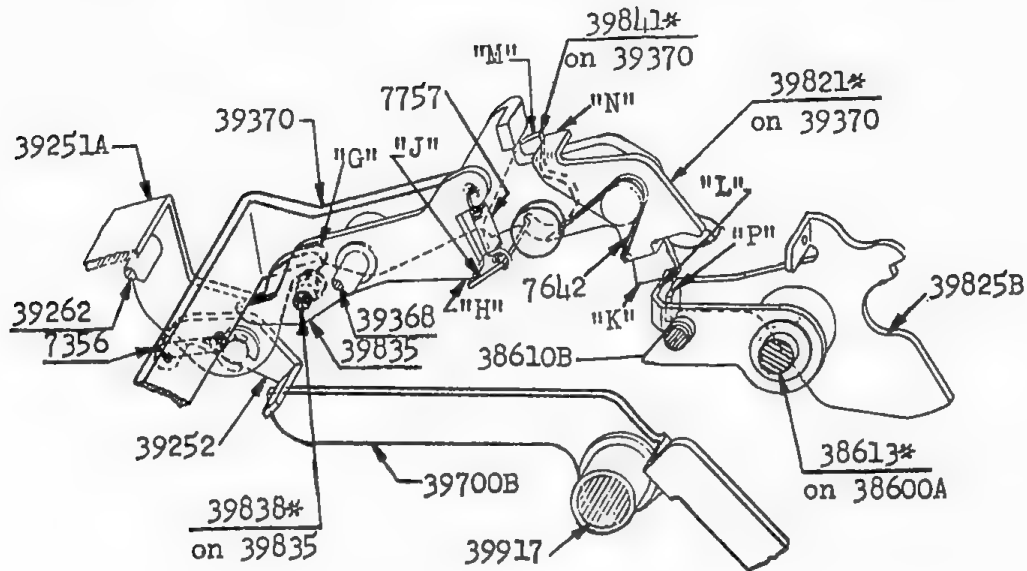


FIG. 63

2. (Fig. 62). The Live Point-39252 is provided as a yield in the event the Front Dial Lock Key is depressed during the Last Restore Cycle at a time when ear "F" on 39397 has already been engaged by hook "E" on 38470.

3. (Fig. 63). When using a constant multiplier the X-Key must be depressed in order to align the carriage with the leftmost digit. If the multiplicand is entered into the Keyboard prior to that X-Key depression the Key-

board entry must be prevented from entering the Storage Mechanism and the Front Dials as upon normal X-Key depression. This is accomplished by the following mechanism: When the Front Dial Lock Bail-39251A rocks clockwise the nose "G" contacts Stud-39838* on the Interponent-39835, thereby rocking 39835 counter-clockwise and moving its nose "H" away from ear "J" on the Block-39841* on 39370. If the Live Point-39821* is in its clockwise position, (Bail-

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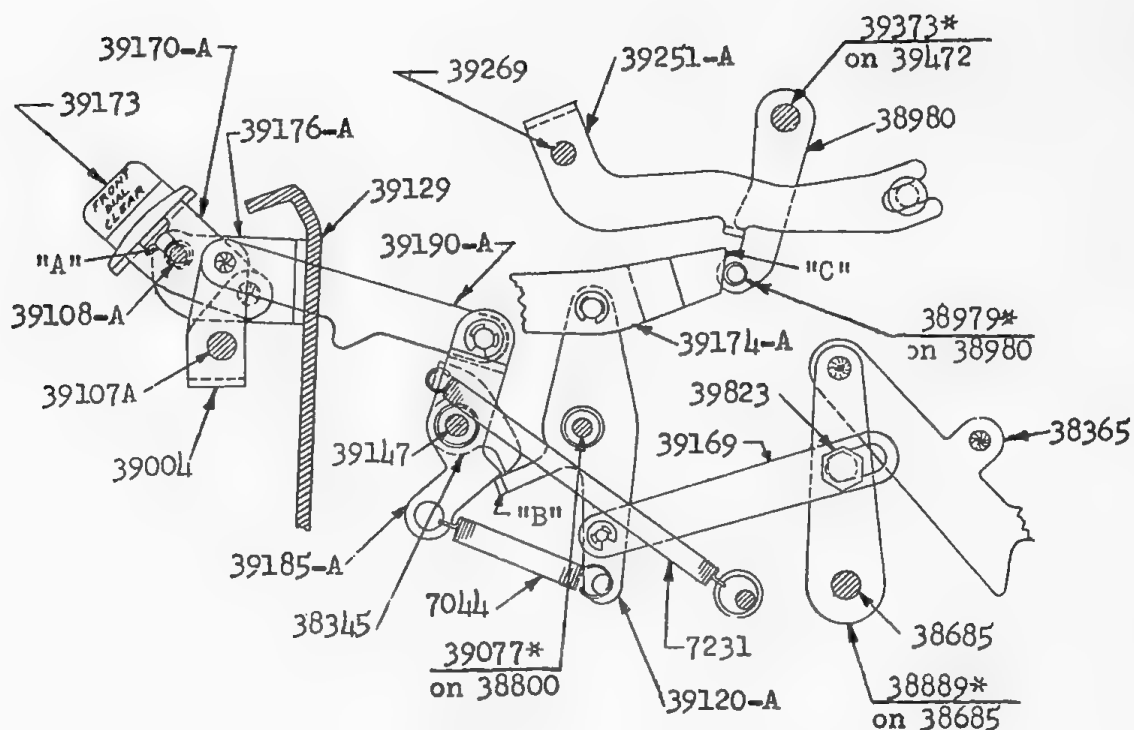


FIG. 64

39370 down, surface "K" in front of ear "L" on 38610B), or when 39821* is rocked, (by Stud-39776* on 38635A on the Master Clutch Cycle), the surface "M" on 39841* can snap under ear "N" on 39821*. This blocks the Live Point-39821* in such a position that, when 39370 is rocked, the tip "K" on 39821* contacts only the ear "L" on Lever-38610B, but not ear "P" on Latch-39825B. The Latch-39825B is not rocked to position the

Link-38341B and therefore the Keyboard is not permitted to be cleared.

X. FRONT DIAL CLEAR KEY:

A. (Fig. 64). The Front Dial Clear Keytop 39173 is mounted on the Key Stem Bail-39170A. The two arms of 39170A are connected to the Control Bail-39004. When the Key 39173 is depressed, Keystem 39170A slides down Shaft 39108A by its slots "A", thereby causing the Control Bail-39004 to be rocked clockwise.

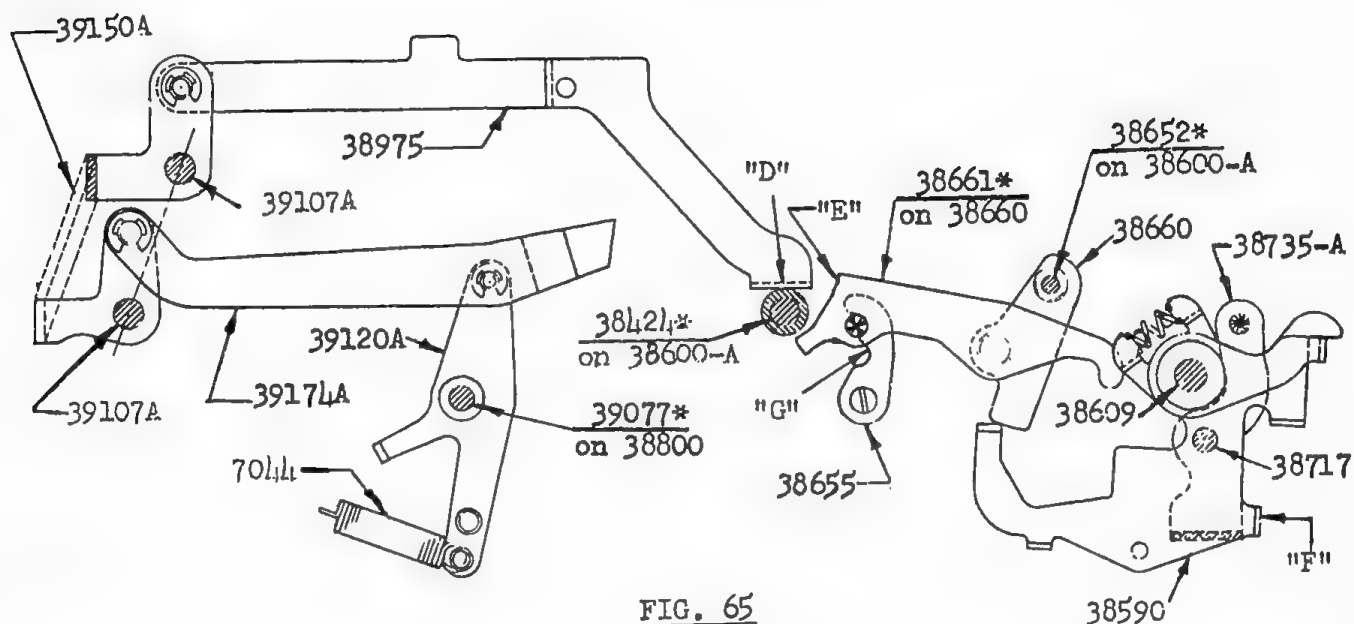


FIG. 65

This rocks the Front Dial Clear Latch-39185A clockwise through Link-39190A, allowing the ear "B" on the Front Dial Clear hatchet-39120A to rock clockwise under tension of its Spring-7044. Connected to the upper end of 39120A is the Link-39174A which is now moved rearward so that its surface "C" rocks the Bail Latch-38980 through Stud-38979*, thus releasing the Bail-39251A and the Front Dial Lock Key. (See Fig. 62, Page 1287).

B. (Fig. 65). The front end of 39174A is connected to the left

arm of Power Bail-39150A so that 39150A rocks clockwise when the Front Dial Clear Key is depressed. This causes the Clear Link-38975, which is attached to the left arm of 39150A, to move rearward until its ear "D" contacts the Inter-ponent-38661* on 38660 at "E", which releases the Termination Lever-38590 in the same manner as described in Section VI-Para. C-2, page 1279. When 38590 rocks clockwise its ear "F" rocks the Blank Setting Cycle Bail-38735A, thus initiating a "Blank Cycle", which per-

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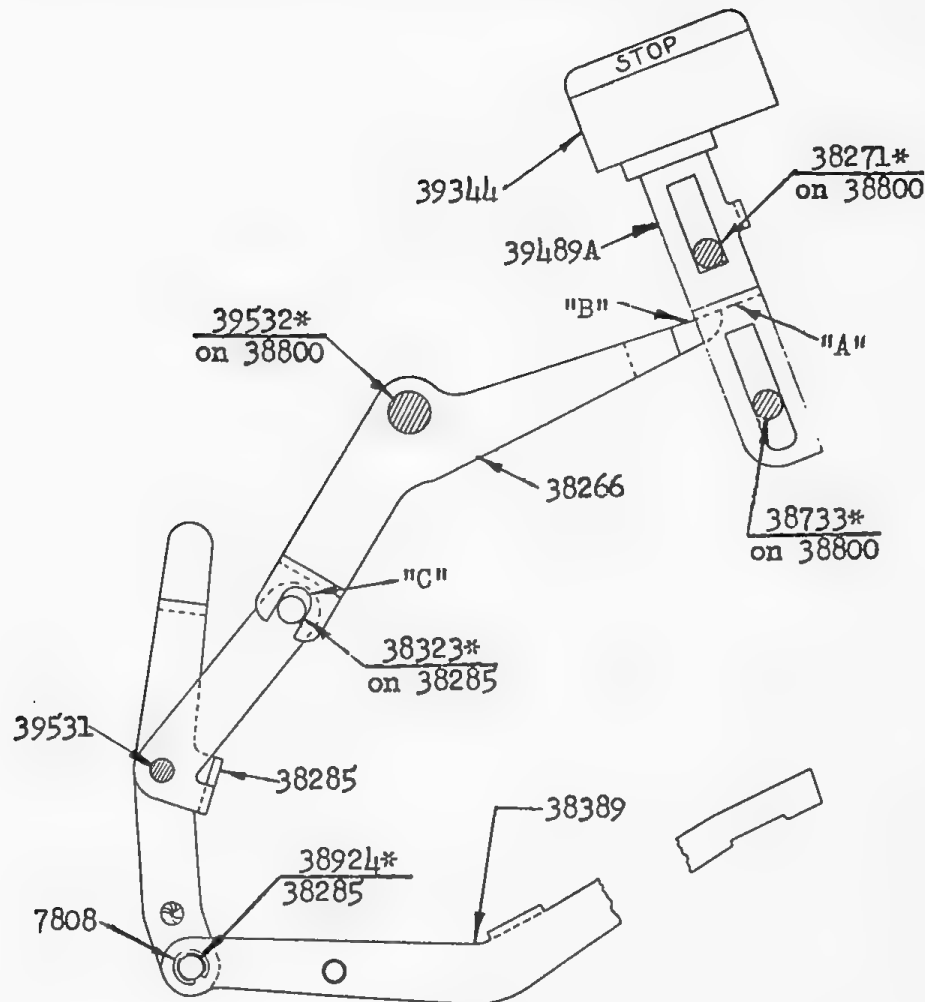


FIG. 66

forms all of the "Last Restore" functions described in Section VI-Para. C-3, page 1280.

C. (Fig. 64). The Front Dial Clear mechanism is restored by Link-38365 through Eccentric-39823 and Restore Link-39169. If the key is held depressed during the Restore Cycle the ear "B" on 39120A comes to rest on Block-38345 which has been provided

to limit the operation to a single cycle.

D. (Fig. 65). If the Front Dial Clear Key is depressed during X- or Equals Key operation it will only release the Front Dial Clear Key, (if it is latched). The termination Lever-38590 will not be released because the Interponent is then held in the lower notch "G" of Detent-38655, so that ear

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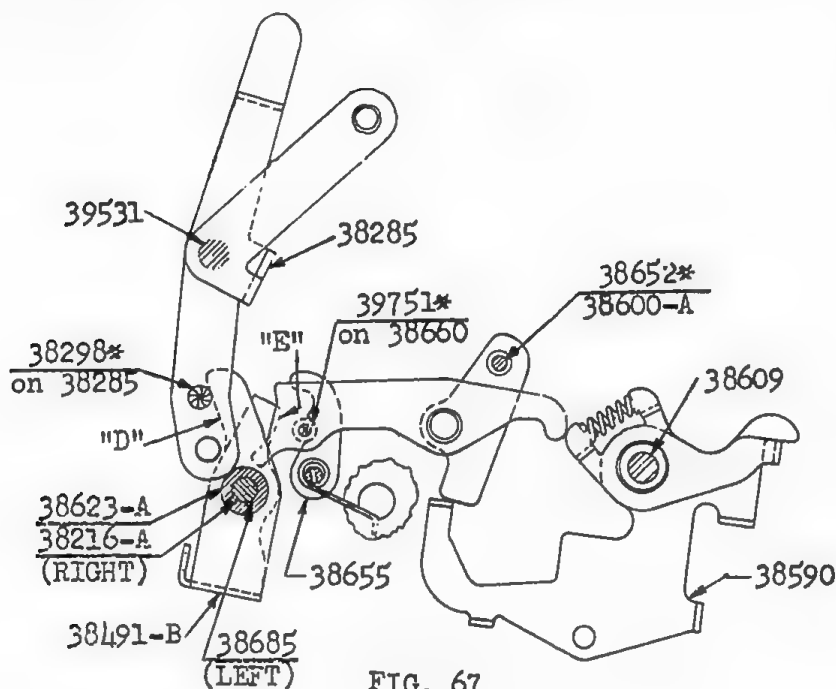


FIG. 67

"D" on 38975 misses it entirely.
The clearing operation will occur normally at the end of the problem.

XI. STOP KEY:

A. Depression in Division:

1. (Fig. 66). Upon depression of Stop Key- 39489A, its shelf "A" contacts "B" on the Stop Connecting Lever-38266 and rocks it clockwise. Notch "C" on 38266 embraces Stud-38323* on the Stop Transfer Bail-38285, which in turn moves the Division Stop Link-38389 rearward and from there on operation is the same as in previous models.

B. Depression in Multiplication:

1. (Fig. 67). The Stop Transfer Bail-38285 has a Stud-38298* which contacts surface "D" on the Lower Stop Bail-38491-B. Since the Stud-39751* on Latch-38660 is in the lower notch of Detent-38655 during multiplication, it can be contacted by the left arm "E" of 38491B. This releases the Terminating Lever-38590 in the same manner as the termination of multiplication. (See Section VI-Para. C-1 on Page 1278).

2. (Fig. 67). If the carriage is to be brought back to tab position after X-Key depression without a

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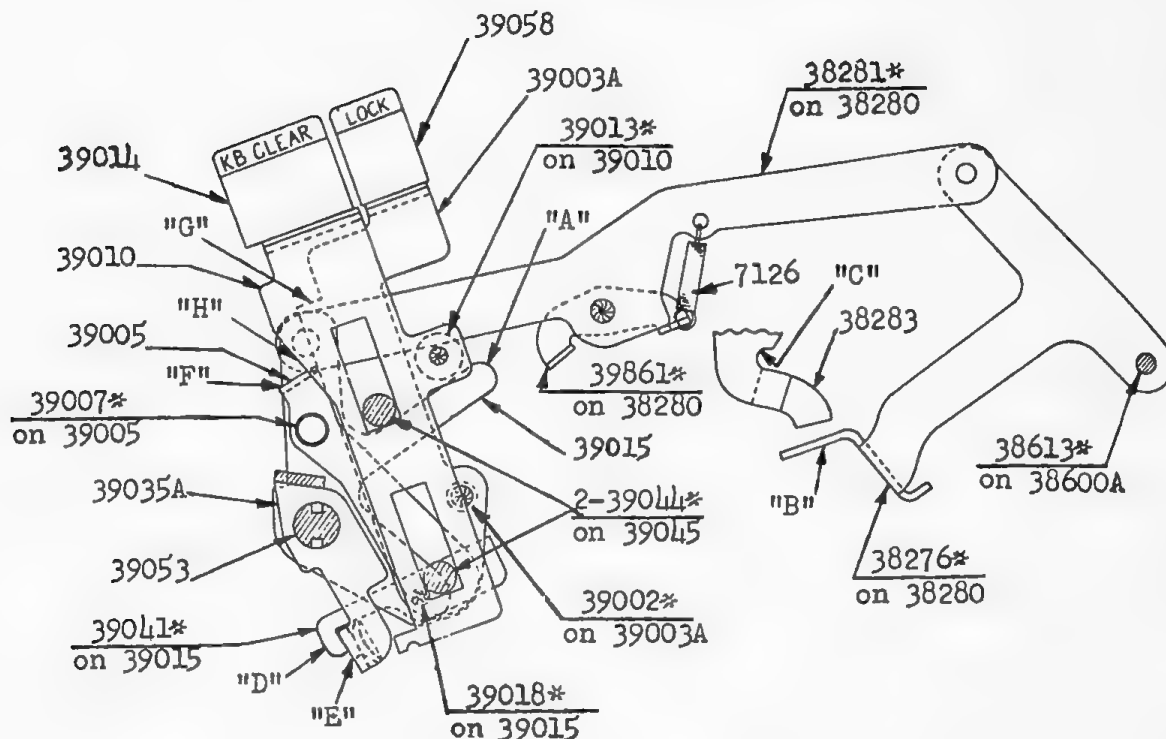


FIG. 68

following Equals Key depression, the Stop Key may be depressed to initiate a Last Restore operation by releasing 38590 as above. If the Front Dial Lock Key has been depressed the carriage will return to home position without clearing the Front Dials.

XII. KEYBOARD CLEAR KEY:

A. Keyboard Clearance:

1. (Fig. 68). The Selection Keyboard Clearance in this model is similar to the one that is used

in Model "EFA". Depression of the Keyboard Clear Key-39010 causes its Stud-39013* to contact surface "A" on the Automatic Keyboard Clear Lever-39015, rocking it clockwise, thereby rocking the Selective Keyboard Clear Bail-38276* on 38280 clockwise through Link-38281*. This moves the ordinal Fingers "B" up into contact with the Lock Bar Control Levers-38283, thus clearing the Keyboard unless the Keyboard entry has been partially or totally

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locked.

B. Locking Entry Into Keyboard:

1. (Fig. 68). If the Keyboard Clear Key-39010 is held depressed during Keyboard entry the Fingers "B" hold the Levers 38283 in such a position that an ear on the Lock Bar underlies surface "C" on 38283, preventing clearance of the Keyboard if the Keyboard Clear Key is depressed later and preventing all automatic Keyboard clearances of any number locked in this manner.

XIII. KEYBOARD LOCK KEY:(Fig. 68).

Depression of the Keyboard Lock Key-39003A, prevents all Automatic clearances (except the one upon X-Key Depression, see Section V-Para. A-11, page 1257), by rocking the Live Point-39041* on 39015 Clockwise Through its stud-39002* thereby disengaging the hook "D" From ear "E" on the Automatic Keyboard Clear Bail-

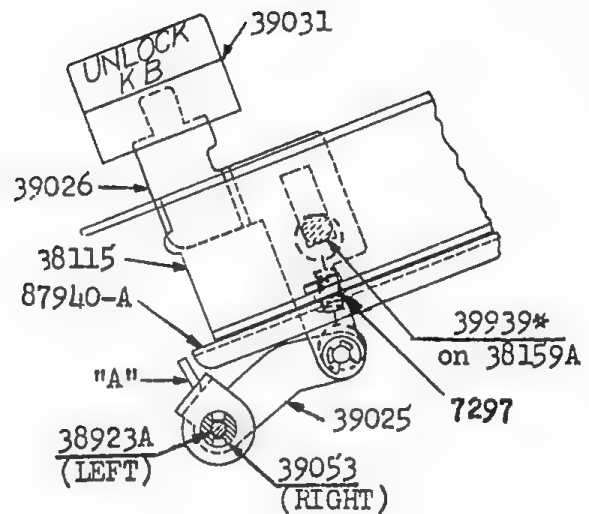


FIG. 69

39035A. This breaks the connection between 39035A, (which is rocked for all automatic clearances), and the Bail-38280. The Keyboard Lock Key is latched down by ear "F" on the Latch-39005 engaging surface "G" on the Keyboard Lock Key-39003A. Surface "H" on the Keyboard Clear Key-39010 unlatches the Lock Key by rocking 39005 counter-clockwise through Stud-39007* on 39005.

XIV. UNLOCK KEYBOARD KEY:(Fig. 69).

Depression of the Unlock Keyboard Key-39026 rocks the Keyboard Un-

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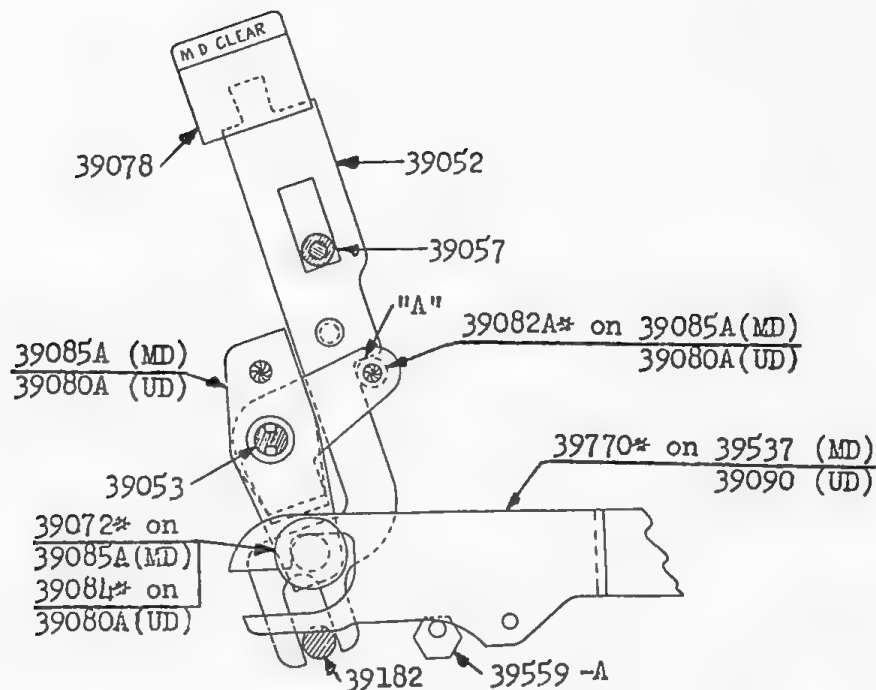


FIG. 70

lock Bail-39025 clockwise so that the form "A" moves all Lock Bars-87940A rearward, thus clearing the Keyboard, regardless of whether any digits are locked or not and allowing the Levers-38283 to drop for later Keyboard clearances.

XV. MIDDLE & UPPER DIAL CLEAR & LOCK KEYS:

A. (Fig. 70 & 71). The operations of the Middle Clear and Upper Dial Clear Keys and their respective Lock Keys are identical, although some of the parts involved are shaped differently. The operations of the

Middle Clear and Lock Keys only will be described here with the equivalent numbers for Upper Dial Clearance indicated on the illustrations.

B. When the Clear Key-39052 is depressed its surface "A" contacts Stud-39082A* on the Middle Dial Clear Bail-39085A, rocking 39085A clockwise. The lower right arm of 39085A carries a Stud-39072* which pulls the Clear Link-39770* on 39537 forward to open the Middle Dial Clear Clutch in the standard manner.

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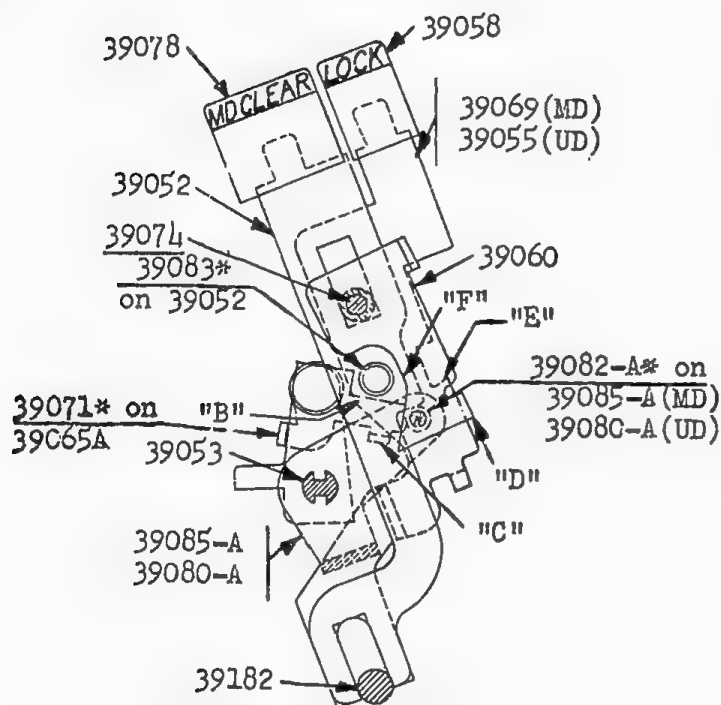


FIG. 71

C. Depression of the Lock Key-39069 prevents all automatic Clearances, (except the M.D. upon Dividend Key Depression), by rocking the Live Point-39071* on 39065A through surface "B" on 39069 and ear "C" on 39071* so that the tip of 39071* misses Stud-39082A* on 39085A when the Clear Operating Arm-39065A is rocked to give an automatic clearance. Latch-39060 has an ear "D" which latches Surface "E" on the Lock Key-39069 until it is unlatched upon

depression of the Clear Key-39052 by Stud-39083* camming surface "F" on 39060 counter-clockwise.

XVI. COUNTER CONTROL KNOB:

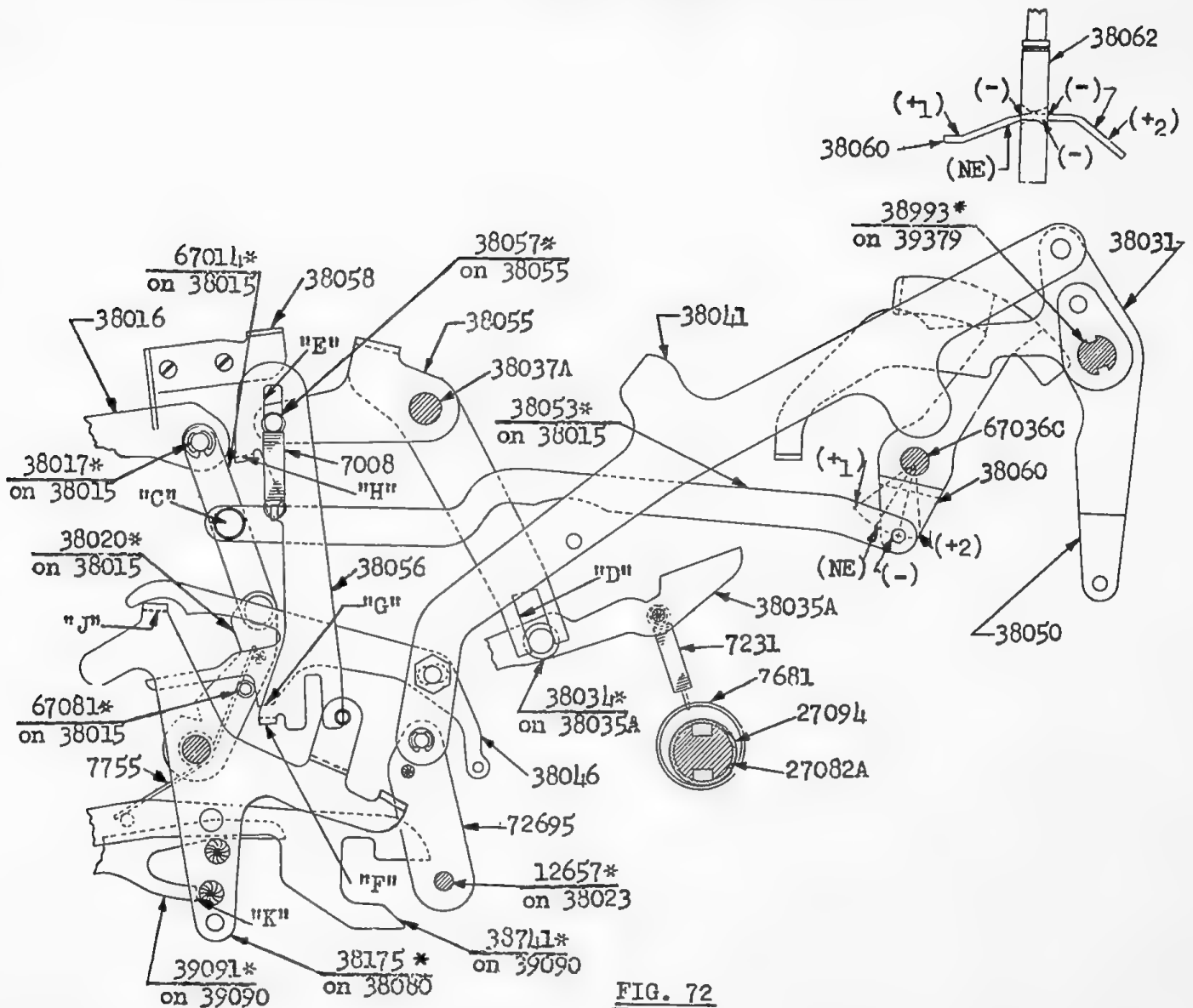
A. General Outline:

1. (Fig. 72). The operation of the Register is controlled by the following three components:

- a. The position of the Counter Control Knob-39468.
- b. The direction of rotation of the Actuator.
- c. The position of the Counter Reverse Lever-38020* on 38015.

The basic difference between the SKA Counter Control and the one used on previous models is that the Register Dials on SKA always count in the direction indicated by the Knob, independent of whether a positive or negative Actuation takes place within the machine. The only exception to this is the case of division with the Knob at

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"X-NE", which results in positive count, since division without Counter registration would be senseless. The correction strokes in division are, of course, always counted in the opposite direction. It should also be noted that the Counter

Control Lever-38020* is spring urged rearward so that it cannot assume a forward position when the machine is at rest.

2. (Fig. 73). The Counter Control Knob-39468 has a slot "A" which moves Stud-38007* on the Counter Control Sector-38010 to one of



1. (Fig. 72, 74). The Cam-38060 can assume six positions which correspond to the six positions of Link-67014* which in turn result from the

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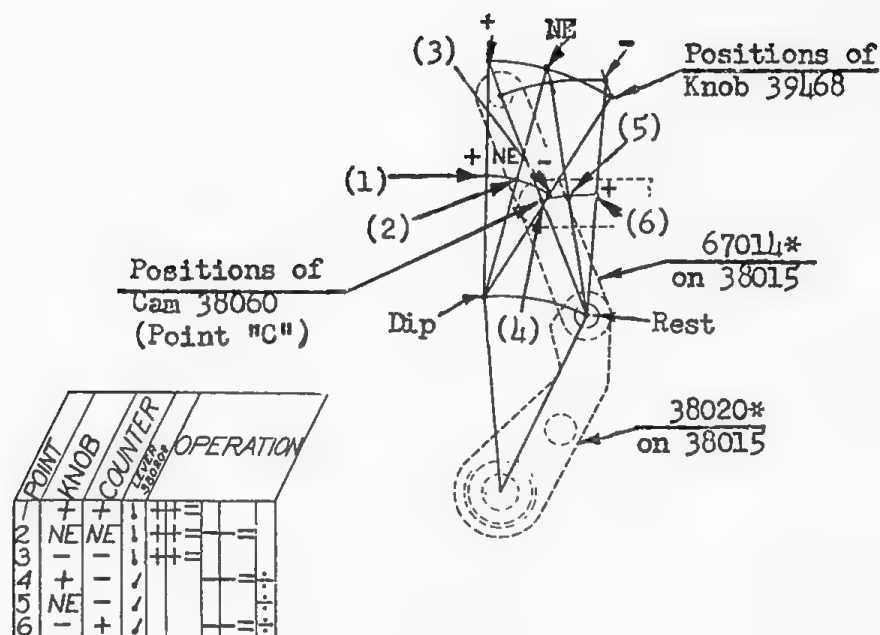


FIG. 74

three possible positions of the upper end and the two possible positions of the lower end. The positions of point "C" are therefore as shown in Fig. 74 above.

It can be seen that 38020* is rocked forward on the positive actuations, (addition, positive Equals operation).

In negative actuations, (subtraction, negative Equals operation); the Reverse Setting Bar-38035A is moved forward. (See Sections IV, page 1247 and VII, page 1284). Stud 38034* on 38035A engages slot "D"

on the Reverse Sensing Bail-38055 which is then rocked clockwise. Stud-38057* on the right arm of 38055 rides in a slot "E" on the Disabling Link-38056 and rocks 38056 through Spring-7008 upward in such a manner that ear "F" on 38056 contacts surface "G" on 38046, thereby moving 38046 to a position where it cannot contact Stud-67081* on 38015 when the carriage dips. For instance, in a subtract operation with the Knob at "+", the point "C",

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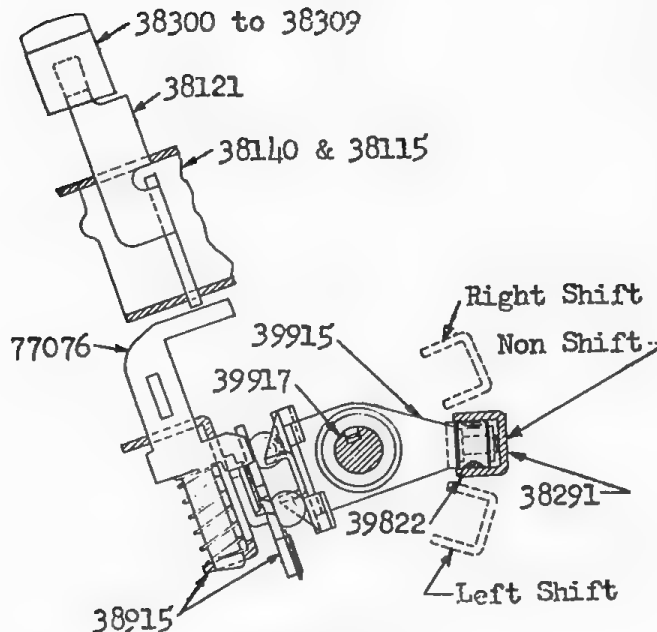


FIG. 76

the Live Point-39071* on 39065-A clockwise through ear "N". The result of moving surface "P" on 39071* to a position where it cannot contact Stud-39082A* on 39080A is the same as depression of the Upper Dial Lock Key. (Section XV-Para. C, page 1296).

XVII. HALF CENT LEVER:

The Half-Cent mechanism on Model SKA is identical to the one described in the "TWIN-SET" Service Instructions (pages 1194, 1196) except that on SKA the Operating Lever is located between the 7th and 8th Dials

in the Carriage.

XVIII. SPLIT CLEAR KNOBS:

The Product Split Clearance mechanism on Model SKA is identical to the one described in Service Instruction Book, Pages 930-933, with revisions as noted on various Design Changes Letters.

XIX. DECIMAL KEYS:

A. Shift Initiation and Restore:

1. (Fig. 76). Depression of a Decimal Key-38121 lowers the tab Key Stem-77076 and controls the position of the Tab Control Bail-

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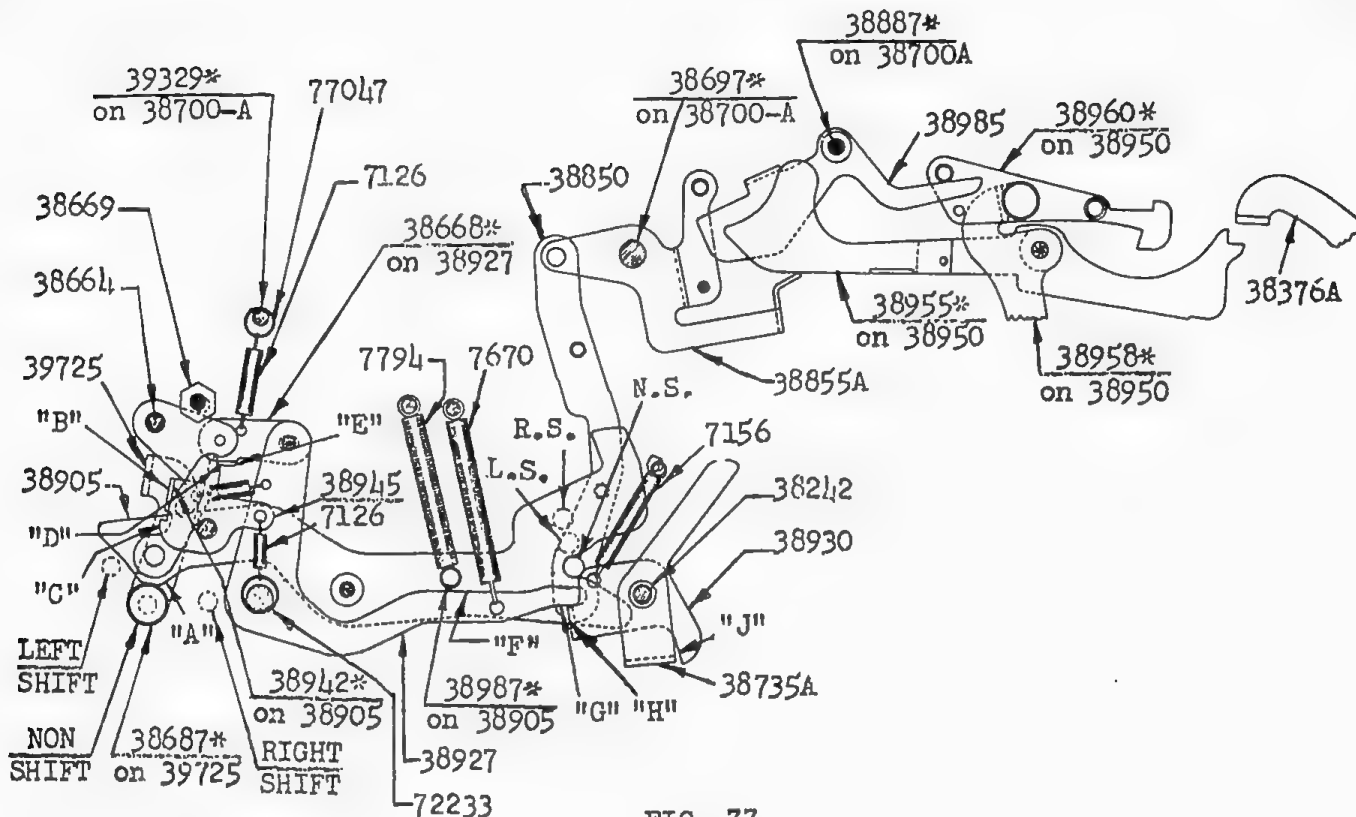


FIG. 77

38291 through Tab Traveller-39915 in much the same manner as in Model AB-10FA; in Model SKA, however, the Tab Control Bail pivots around the Worm Shaft-39917, and The shift is initiated by a "Blank Setting Cycle" as follows:

2. (Fig. 77). The Arm-39725, which is fastened to the Tab Control Bail-38291 (Fig. 76), carries a Roller-38687* which positions the Tab Control Lever-38905. When

Roller-38687* moves out of its "non-shift" position the contour "A" on the Lever-38905, follows it and 38905 is thus allowed to rock counter-clockwise under tension of Spring-7794. When the forward end of 38905 moves down the ear "B" on the Dog-38942*, which is fastened to 38905, contacts surface "C" on the Shift Assist Latch-38945, and rocks 38945 counter-clockwise, removing the surface "D"

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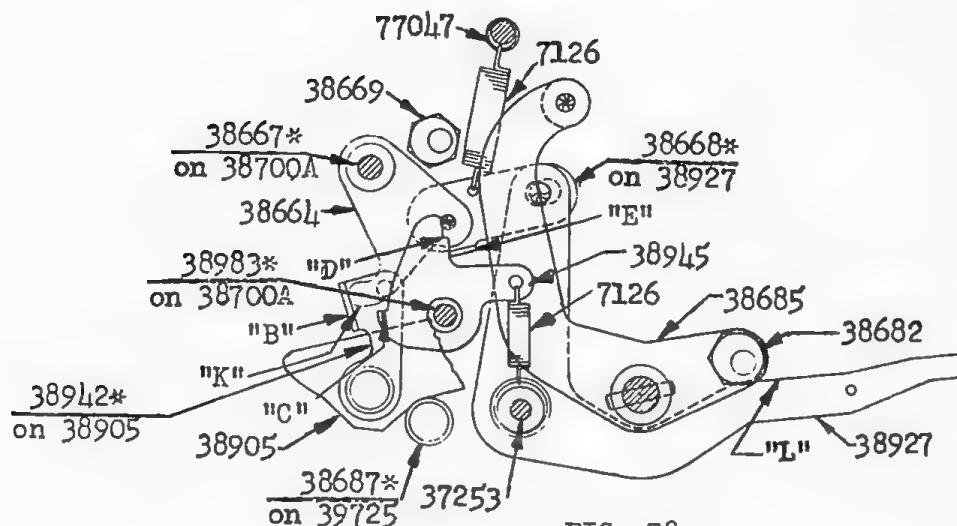


FIG. 78

from under ear "E" on Link-38668* and thereby allowing the Shift Assist Lever-38927 to rock counter-clockwise under tension of its Spring-7670. Surface "F" on 38927 contacts Stud-38987* on 38905 and thus helps 38905 to assume its positions as determined by Roller-38687*.

3. (Fig. 77). The rearward extending arm "G" on 38927 overlies ear "H" on the Shift Starting Bell-crank 38930. When 38927 rocks counter-clockwise it allows 38930 to rock clockwise under tension

of Spring-7156 so that its surface "J" can rock the Blank Setting Cycle Bail-38735A to initiate a Setting Cycle in the usual manner, at the end of which the shift clutch is opened.

4. (Fig. 78). Link 38664, which rocks clockwise when 38668* is released, has a nose "K" which then rocks the Dog-38942* through ear "B" in such a manner that ear "B" is removed from over surface "C" on 38945. This action frees 38945 so that it can again latch ear "E" on 38668* when the Shift Assist Lever-38927 is re-

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stored during the setting cycle.

5. (Fig. 78). The Booster Restore Lever Pinning-38685 is rocked clockwise during the Setting Cycle, (See Section III-Para. B, page 1244), causing Eccentric-38682 to contact surface "L" on the Shift Assist Lever-38927, rocking it clockwise. This allows the toggle arrangement of 38668* and 38664 to be straightened by Spring-7126 until 38664 stops on Eccentric-38669. Ear "E" can then be latched by surface "D" on 38945.

B. Shift Direction Indication:

1. (Figs. 76, 77). If a Decimal Key to the left of the present decimal position is depressed the Tab Control Bail-38291 and its attached Arm-39725 rock counter clockwise moving Roller-38687* to the "RIGHT SHIFT" position indicated in Fig. 78. This allows the Tab Control Lever-

38905 to rock to its far counter-clockwise position, thereby positioning the Shift Direction Interponent-38985 for a right shift through 38850 and 38855A in the usual manner.

2. (Fig. 77). If a Decimal Key to the right of the present decimal position is depressed the Roller-38687* moves forward to its "LEFT SHIFT" position, allowing 38905 to rock clockwise to a position half-way between non-shift, (where 38955* is held clockwise out of the path of 38376A), and right shift, (where 38985 is rocked counter-clockwise), leaving the shift directional mechanism in its normal left shift position.

C. Shift Termination:

1. (Figs. 76, 77 & 79). When the Tab Traveller-39915 approaches the new decimal order it rocks the Arm-

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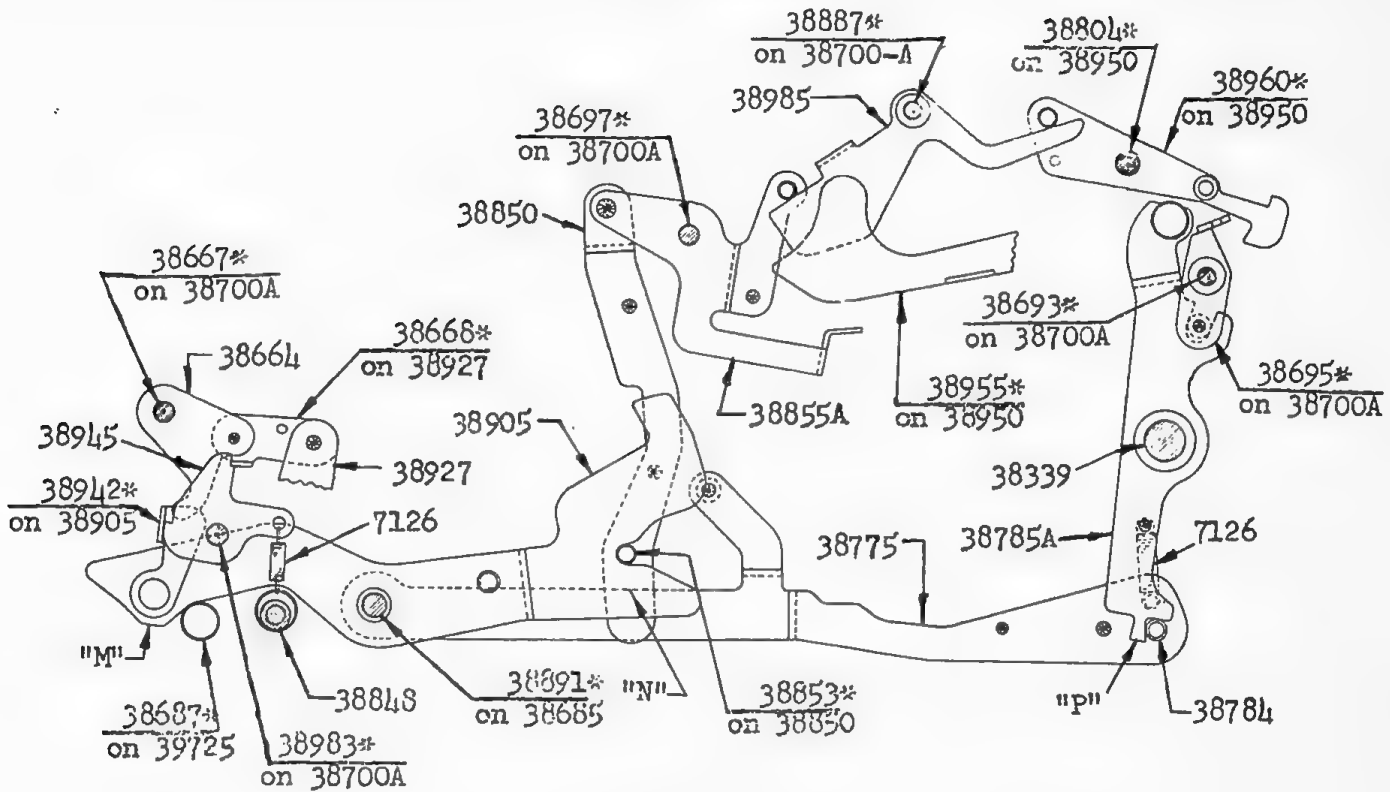


FIG. 79

39725 and its Roller-38687* through Bail-38291 back to its "NON-SHIFT" position and rocks the Tab Control Lever-38905 to a position where 38687* holds surface "M" in non-shift position. When 38905 rocks clockwise it lowers the Shift Direction Link-38850 through Stud-38853*, restoring the Shift Direction mechanism to its non-shift position. Stud-38853* also contacts surface "N"

on the Shift Latch Lever-38775 and lowers it, thus disengaging its Eccentric-38784 from Tip "P", terminating the shift.

D. Decimal Markers:

1. (Fig. 80). When a Decimal Key-38121 is depressed it lowers the Lower Tab Key-77076 as previously explained. Surface "Q" on 77076 overlies ear "R" on the Front Dial Decimal-39130 so that 39130 is rocked clockwise,

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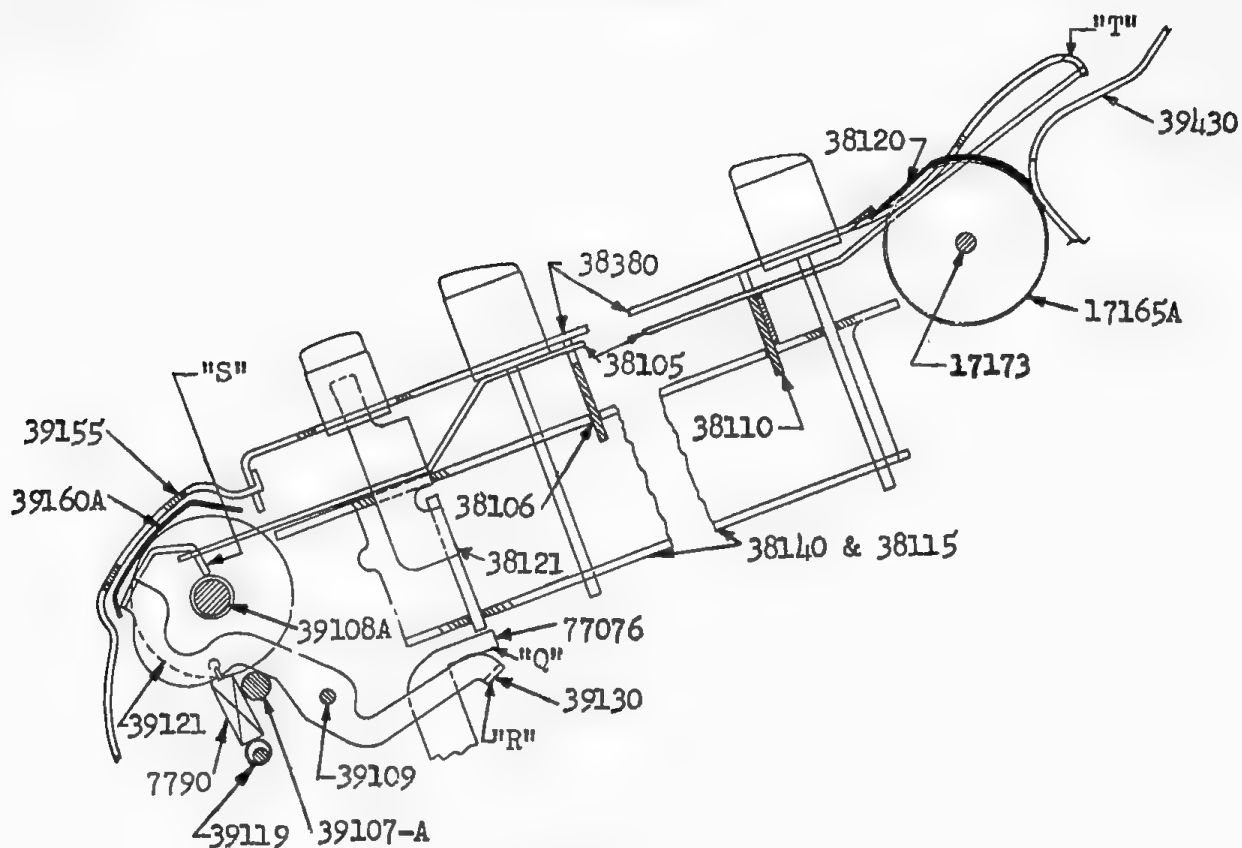


FIG. 80

making its orange surface visible through an opening in the Front Dial Cover-39160A just to the right of the Dial-39121 in the new "home" order, and in line with the depressed Decimal Key.

2. (Fig. 80). The Front Dial Decimal-39130 has a lug "S" on its upper end which engages a slot in the Decimal Bar 38105. When 39130 rocks clockwise it moves Bar-38105, which is guided by Guide-38106 and slots in the Check Dial Cover-38120, rear-

ward. 38105 is alternately painted blue and orange in such a manner that only its blue portions are visible when the respective Decimal Key is up, whereas its orange portions are exposed when it moves rearward upon depression of the Decimal Key, so that orange colored dots appear in line with the Decimal Key all along the Keyboard, to the right of the Check Dial-17165A, and above the Keyboard Cover-38380 at "T" to point out

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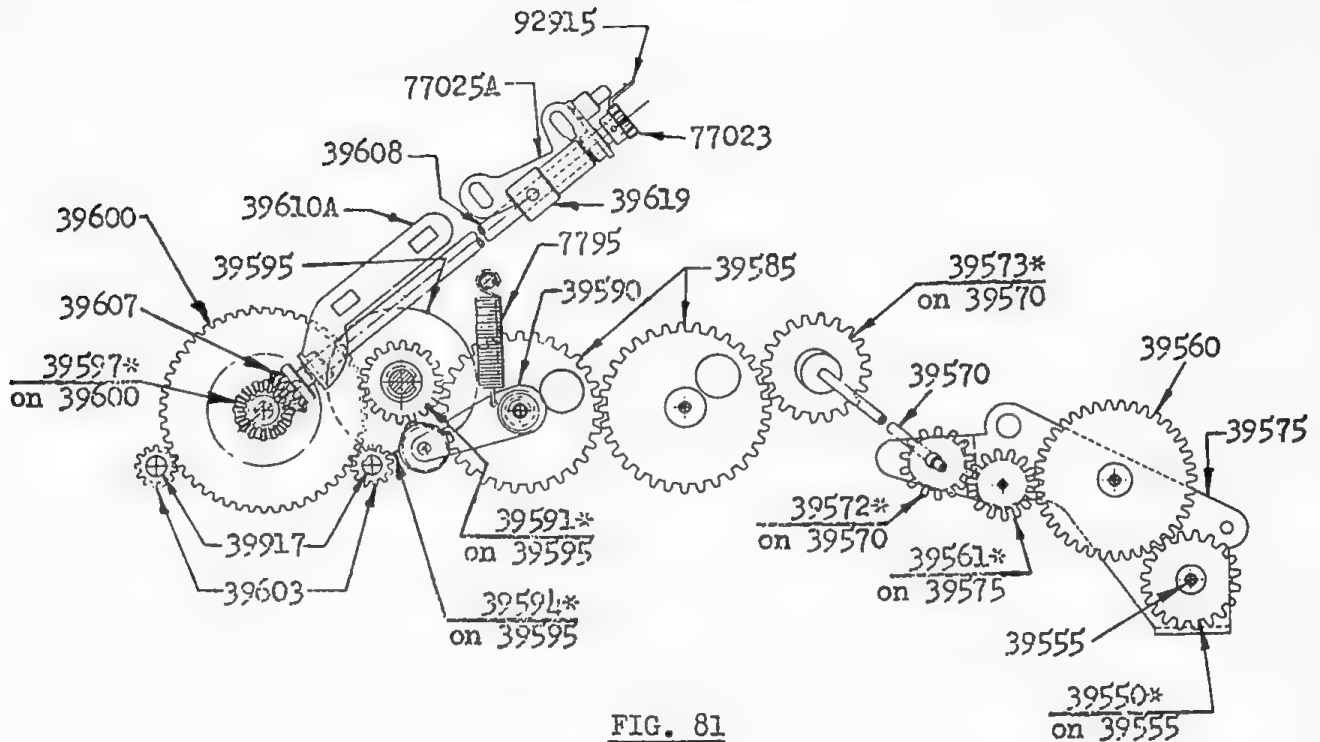


FIG. 81

the decimal point in the Middle
Dials.

E. Drive Train:

(Fig. 81). On Model SKA the carriage drive is modified to both drive the Worm Shafts-39917 and shift the carriage through a gear train starting at the Shift Jack Shaft-39555. Rotation of the Shift Jack Shaft is transmitted to the Gear-39600 through Gears-39560 and 39561* on the Bracket-39575, the Cross Drive Shaft-39570 with its Gears-39572* and 39573*, the two Idlers 39585, and the Double

Idler 39595. 39595 also carries a Centralizer-39594* which makes one full rotation for every order of carriage shift and which is centralized in time with the standard Shift Jack Shaft Centralizer by Roller Arm-39590. Gear-39600 drives both Worm Shafts-39917 through Pinions-39603 in the same rotational direction as the Shift Jack Shaft to laterally drive both the Tab Traveller and the Multiplier Traveller. The Bevel Gear-39597* on 39600

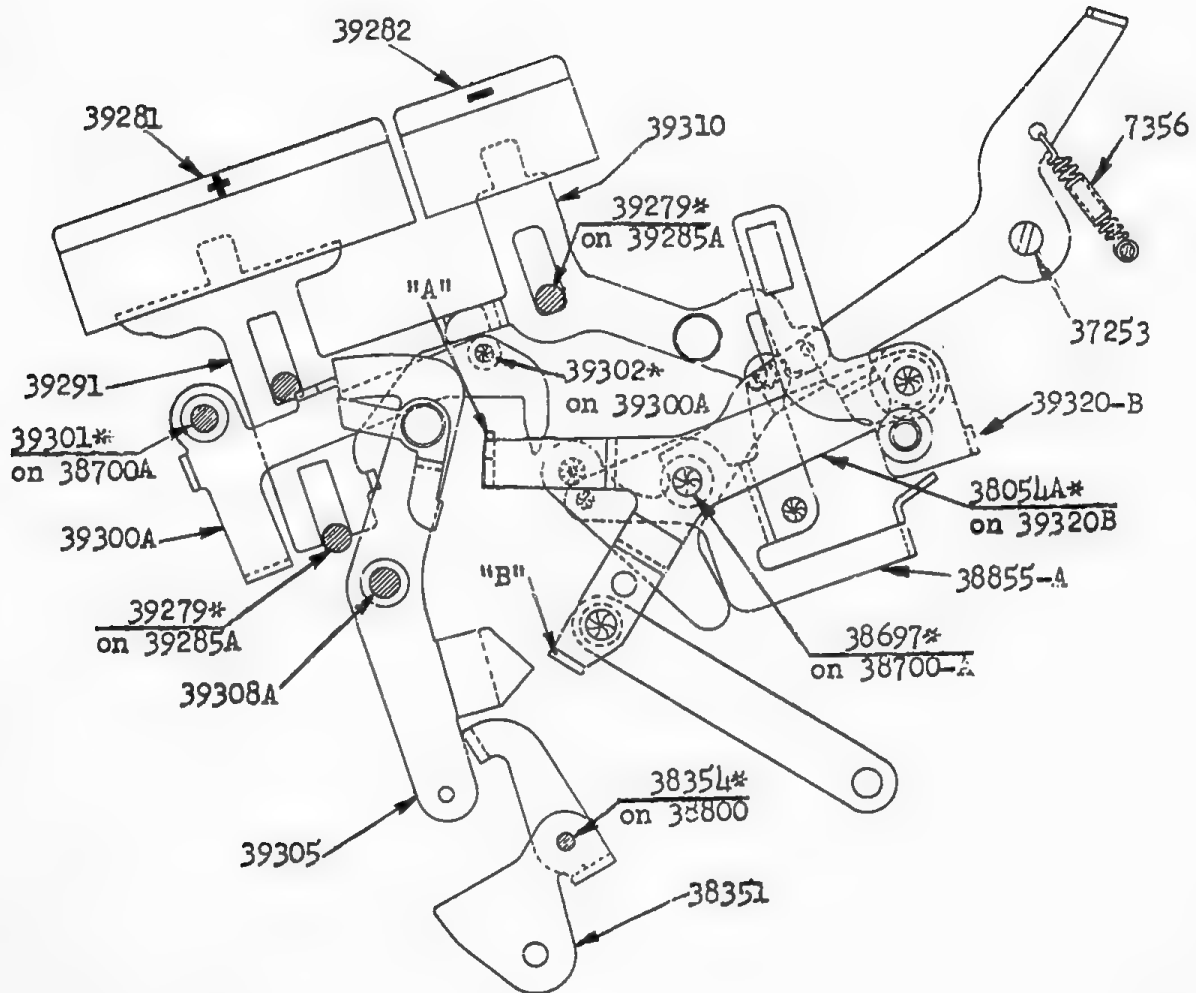


FIG. 82

drives the carriage in a direction opposite to the traveller movement through a Shaft-39608 and its two Gears-39607 and 77023 similar to the standard arrangement, except that in this model it drives the carriage rather than being driven by it.

XX. INTERLOCKS:

A. Add-Division and Sub.-Division Interlock:

1. (Fig. 82). During division, ear "A" on the Division Key Assembly-39320B underlies Stud-39302* on the Add Bell-crank-39300A, thereby preventing depression of Add Key-39291 or Subtract

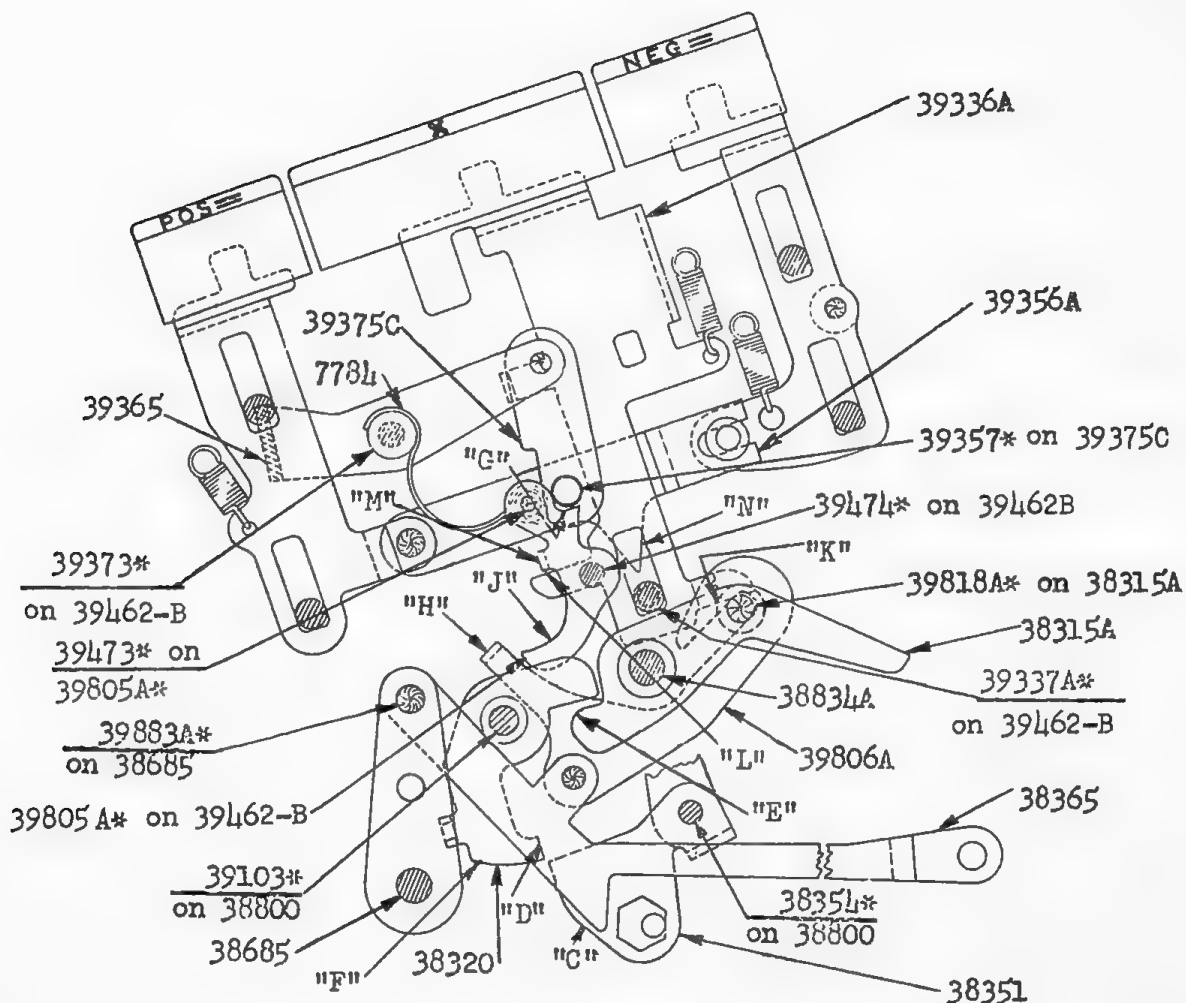


FIG. 83

Key-39310. During an add or subtract cycle, the Add Operating Lever-39305 is rocked counter-clockwise so that the lower surface of its large ear is in a position directly over ear "B" on the Division Key Assembly-39320B, thereby preventing rocking of 39320B.

B. Add-Multiply and Sub.-Multiply Interlock:

1. (Fig. 83). While the Add Operating Lever-39305 is rocked, it holds the Add Restore Bail-38351 in its clockwise position where its surface "C" blocks surface "D" on the Add-Multiply Interlock-38320 from rocking counter-

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clockwise. The Interlock Lever-38315A, which is contacted at its Stud-39818A* by the X-Key-39336A, cannot rock because its surface "E" is blocked by 38320, thus confining 39336A to insufficient movement to initiate an operation. Inversely, while the X-Key is latched down it positions 38320 through 38315A so that its surface "F" prevents the the Add Operating Lever-39305, through Bail-38351, from rocking.

C. Multiply-Equals Interlock:

1. (Fig.83) The depression of an Equals Key upon X-Key depression must be delayed until the multiplier operation is completed. This necessitates a double-step interlock which functions as follows: A Block-39805A* on the Multiplier Sub Frame 39462B has a surface "G" which underlies Stud-39357* on 39375C, blocking the Equals Key when the machine is at rest. The Control

Lever-39806A, pivoted on the Add Restore Link-38365, has an ear "H" which is normally at a position where it misses the surface "J" on 39805A* when 38365 moves rearward on any setting cycle. However, on the setting cycle, which precedes the shift in multiplier operation, ear "H" is in position where it contacts surface "J" rocking 39805A* out from under Stud-39357*. 39806A is enabled to do this by depression of the X-Key-39336A whose surface "K" rocks Stud-39818A*, (which rocks 39806A), clockwise. Toggle Spring-7784 holds 39805A* in its counter-clockwise position until at the end of multiplication the X-Key is released, at which time surface "L" on 39336A contacts Ear "M" on 39805A*, restoring it to its normal blocking position.

D. Equals Key Against Each Other:

1. (Fig.83). Simultaneous depression of

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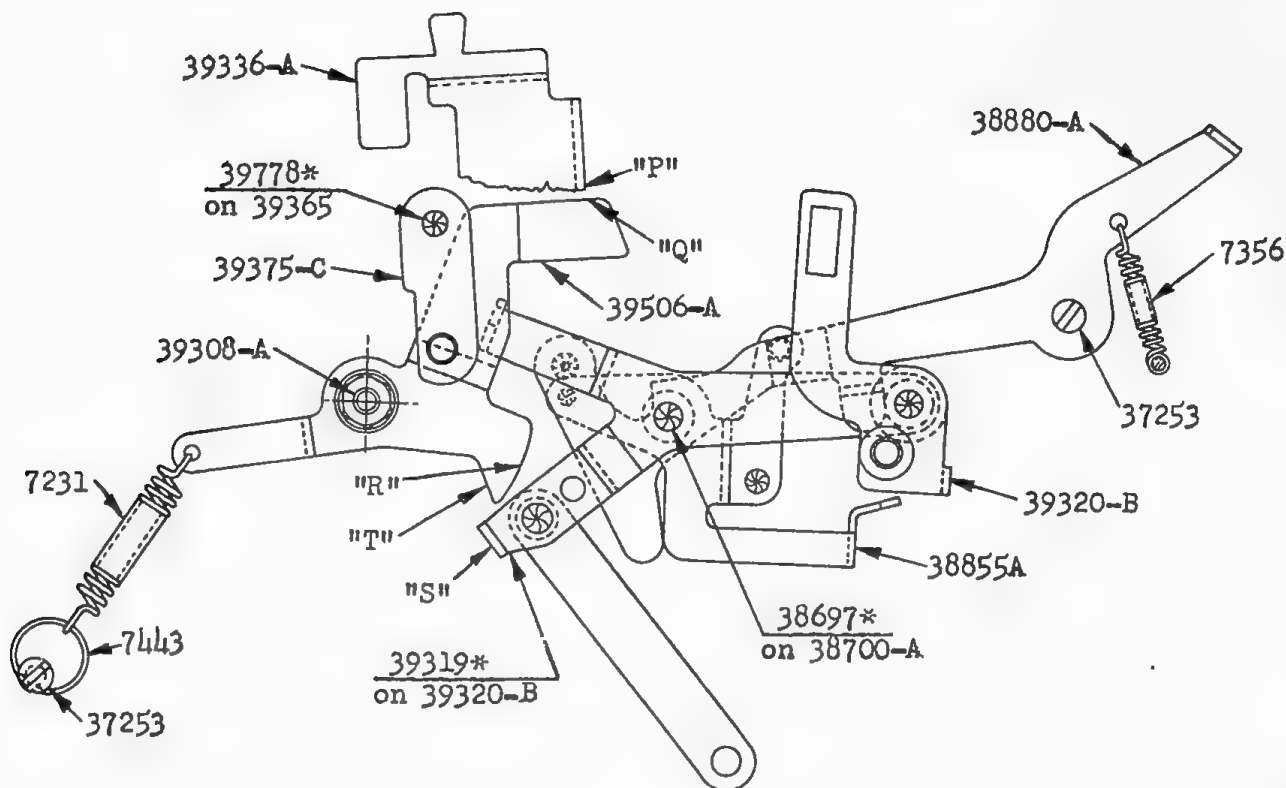


FIG. 84

both Equals Keys or depression of the other one while one is latched is prevented by nose "N" on 39356-A which comes to rest on either side of Stud-39337A* on 39462B depending on which Equals Key has been depressed first.

E. Multiply-Division Interlock:

1. (Fig. 84). Depression of the Multiplier Control Key Stem-39336A causes ear "P" to contact surface "Q" on the

Division-Multiplier Interlock-39506A, camming it clockwise. This clockwise movement of Interlock-39506A positions its surface "R" in the path of ear "S" on the Division Multiplier Interlock Bracket-39319* on the Division Key Assembly-39320B, thereby preventing downward movement of the Division Key Assembly-39320B.

2. During division operations, depression of the Multiplier Control Key Stem-39336A is prevented by

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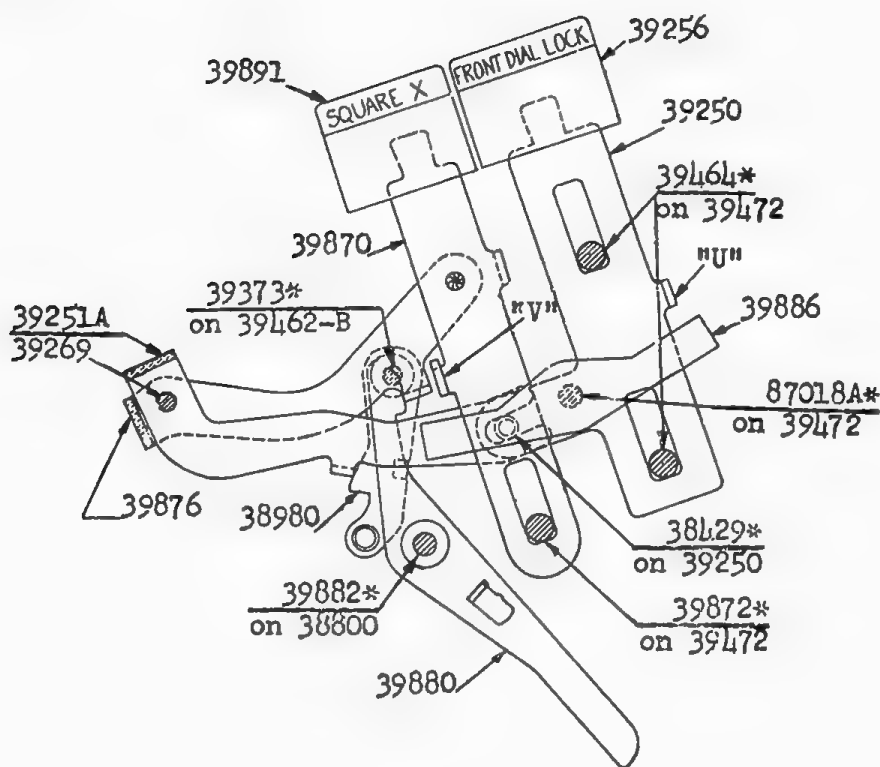


FIG. 85

ear "S" on the Division Multiplier Interlock Bracket-39319* overlying surface "T" on the Division-Multiplier Interlock-39506A in such a manner that 39506A blocks downward movement of the Multiplier Control Key Stem-39336A.

F. Square-Front Dial Lock-Interlock:

1. (Fig. 85). In order to prevent accidental simultaneous depression of both the Square and the Front Dial Lock Keys an Interlock-39886 is

provided which underlies the ear "U" on the Front Dial Lock Key-39250 on one end and ear "V" on the Square-X-Key-39870 on the other end, preventing the depression of one key while the other one is latched.

G. Stop Key Interlock:

1. (Fig. 86). In both multiplication and division the shift mechanism is returned to tab control upon depression of the Stop Key. (Section VI-Para. C-7 on Page 1283). If the Stop

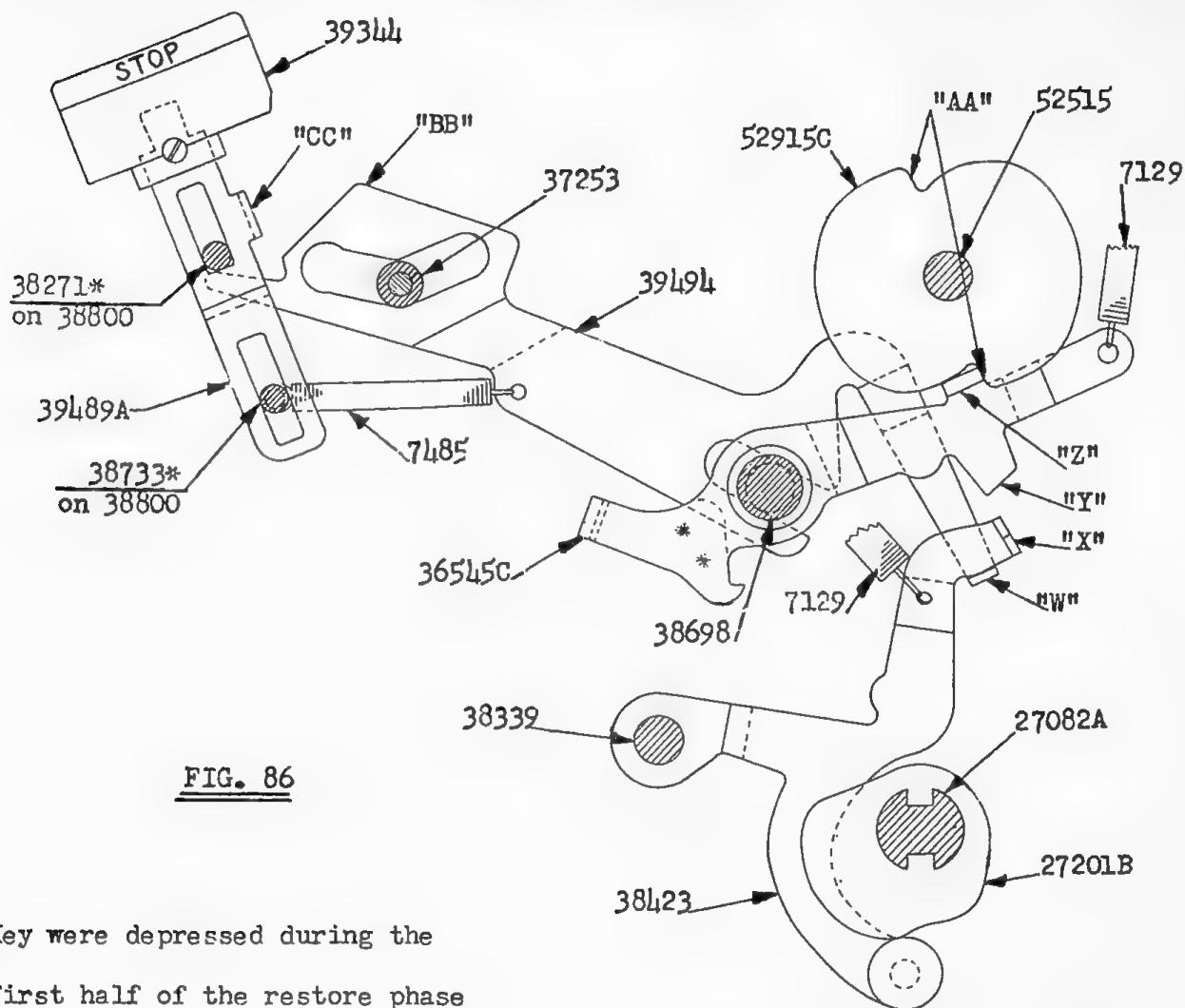


FIG. 86

Key were depressed during the first half of the restore phase of the setting cycle the Shift Direction Interponent-38960* on 38950, (Fig. 41, page 1266), would be moved toward its right shift position just at a time when it is moved forward to initiate a normal left shift. Since this may result in a jamming condition the following mechanism has been provided to prevent Stop Key depression during that critical period.

While the machine is at rest and during Setting and the Main Clutch Cycles, the Blocking Slide-39494 is held in a non-blocking position by 38423 overlying ear "W" on 39494. Lever 38423 is held in this position either by Cam-27201B or by its ear "X" resting on surface "Y" on the Main Clutch Dog-36545C. At the end of the last Main Clutch cycle ear "Z" on 36545-C

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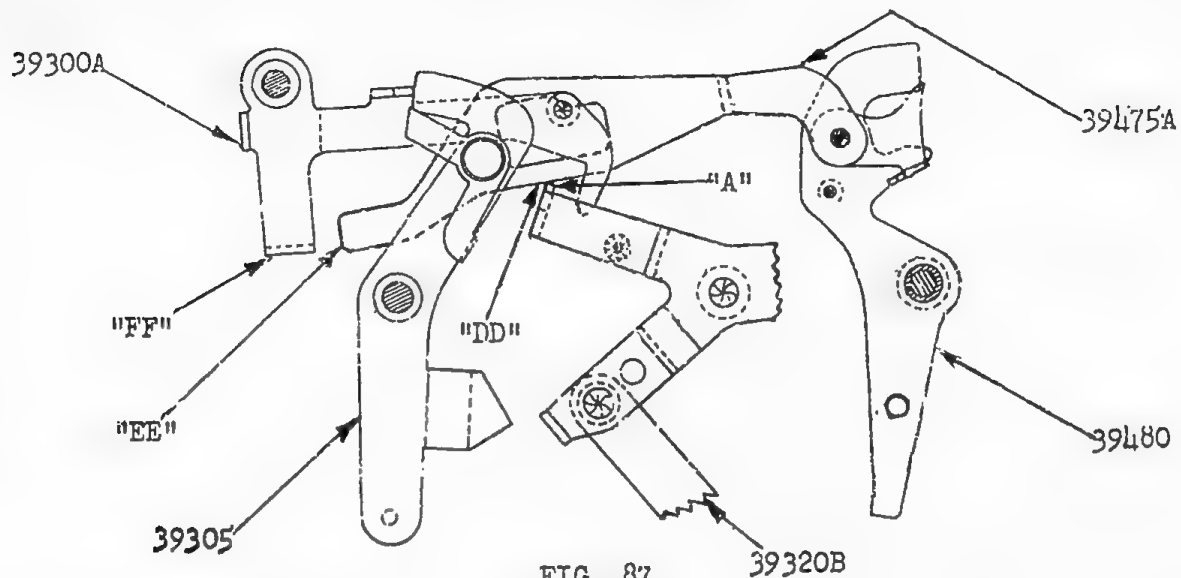


FIG. 87

returns into its notch "AA" in Cam-52915C, allowing ear "X" on 38423 to slide off surface "Y" on 36545C. This allows the Slide-39494 to move to a position where its surface "BB" lies directly under ear "CC" on the Stop Key-39489A. It remains there until removed during the latter part of the restore cycle, when Cam-27201B moves 38423 back to its normal position.

H. Division-Dividend Interlock:

1. (Fig. 87). The interlock mechanism to be described below is in the event that the Dividend Key is depressed during division. When the Division Key is depressed causing the Division

Key Assembly-39320B to rock clockwise, ear "A" on 39320B contacts surface "DD" on Add Operating Link-39475A and lifts 39475A upward. Thus, when the Dividend-Entry Hatchet-39480 is recocked, surface "EE" on Link-39475A cannot contact ear "FF" and rock the Add Bellcrank-39300A.

J. Other Interlocks:

All other operations not mentioned above are interlocked against each other by standard means such as the Shift-Clear Interlock on the Switch Pinning. This also applies to parts of operation such as the clearance on Dividend Entry operation or the Setting Cycle on Tab operation.

SK, SKA DIVISION and LINE-UP, SECTION II

The attached pages 1213 to 1243E completes the revised Deci-Magic Service Instruction Book per Design Change #503 dated Feb. 3, 1958.



DIVISION

II. DIVISION

Operation of the Division Mechanism in the Carriage, Actuator and Selection Unit, as well as the general sequence of clutch operations, has not been changed and a complete understanding of Division Operation in Figuremaster models is necessary before attempting to study the Decimagic Division Controls.

A portion of the Division Control Mechanism has been changed to simplify operations and to provide space for the Multiplier Mechanism. The Main Operating Bar Assembly has been eliminated and the setting clutch opening for all operations is now initiated as explained in Paragraph 170, Page 84 of Consolidated Service Instruction.

A. Light Touch Division Key

The functions performed directly by Division Key depression are:

1. Releases Division Operating Lever.

(Fig. 1). Ear on Key (1) rocks Link (2) clockwise. Stud (A) on Link (2) operating in slot in Key Stem (3) moves

Key Stem (3) downward. As Key Stem (3), pivotally mounted on Lever (4), moves down it rocks Lever (4) clockwise and also moves the center of roller (B) (on Key Stem (3)) below blocking surface (C) on Lever (5). Lever (5) under tension of Spring (6), rocks clockwise and cams roller (B) downward below surface (C) on Lever (5). Lever (5) continues to rotate clockwise until surface (D) contacts roller (B).

2. Disconnects shift from Decimal Key Control.

(Fig. 2). As Lever (20) rocks clockwise the lower arm contacts surface (A) on Lever (21) rocking it counter clockwise. Surface (B) on Lever (21) contacts stud (C) on Link (23) rocking the lower end of Link (23) rearward. This moves the right end of stud (D) on Link (23) out of the notch of Lever (22), and the left end of stud (D) away from surface (E) on Lever (24).

With Link (23) disengaged from Lever (22), ear (U) on Link (33) will no longer hold Link (31) in the non-shift



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position as shown in Figure 2. Link (31) will now be held in the non shift position by Interponent (52) (Fig. 5) as explained in Paragraph B-3.

It should be noted here also that Spring (T) on Interponent (29) holds Interponent (29) in a counter clockwise position with surface (R) to the rear of ear (Q) on Link (28). This is the normal left shift position for Interponent (29) during all machine operations unless specifically noted otherwise.

At the same time as the lower end of Link (23) is moved rearward Lever (32) is also rocked clockwise through Link (34). This moves the rear end of Link (25) forward and downward and the front end forward. As Link (25) moves forward, surface (G) moves over the top of stud (H) on Lever (22) and blocks Lever (22) in its non-shift position until the completion of division. As roller (F) on Link (25) moves down and forward it contacts surface (J) on Lever (24) and blocks

it in a position where stud (K) remains clear of the tip of Latch Control (26). With Lever (22) blocked in a non-shift position and Lever (24) prevented from latching Latch Control (26), all shifts in Division will be single order shifts and will not be affected by the position of the Tabulator Controller 39915 in relation to a depressed Decimal Key.

3. Conditions Operating Lever Latch.

(Fig. 1). Surface (K) on Latch (17) rests on ear of Key Stem (3) (under tension of Spring (18)), which holds surface (L) up out of the path of roller (N) on Lever (5). Depression of Key (1) lowers ear on Key Stem (3) and allows the corner of latching surface (L) on Latch (17) to rest near top of roller (N) on Lever (5) in a near latching condition. Almost simultaneously, of course, roller (B) on Key Stem (3) has released Lever (5).

As Lever (5) rocks clockwise roller (N) cams Latch (17) up slightly and surface (M) rides on top of roller



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(N) under tension of Spring (18).

Latch (17) is thus conditioned to latch Lever (5) when it is re-cocked counter clockwise later in the division cycle.

4. Interlocks.

(Fig. 1). Ear (Q) and ear (E) on Lever (4) function as interlocks and their operation is explained in Section II, Page 1308.

B. Division Operating Lever

Clockwise rotation of the Division Operating Lever performs the following functions:

1. Rotates Division Counter Control Assembly to its full clockwise position.

(Fig. 1). As explained in A-1 above, Key (1) rocks Lever (4) clockwise and releases Lever (5). However, the additional clockwise movement of Lever (4) required for latching is imparted by surface (P) on Cam (19) passing over roller (B) on Key Stem (3). As Lever (4) is thus momentarily rocked to its maximum clockwise position by Cam (19), Latch (7), which is riding against ear (E) on Lever (4) under

tension of Spring (8), rocks clockwise under ear (E). Surface (F) on Latch (7) then blocks Lever (4) in a latched position until the division operation is completed or terminated by depression of the Stop Key.

(Fig. 3). As Lever (35) is rocked clockwise it rocks Assembly (38) clockwise through Link (36). As Assembly (38) rotates clockwise, ear (D) on Arm (39) passes "over center" and Spring (40) now helps rotate Assembly (38) clockwise. Near the end of the clockwise rotation of Assembly (38) stud (C) on Arm (39) contacts the end of slot in Link (41) and stretches Spring (42), leaving a slight gap between Pin (43) and Interlock (44). This exerts a force on Assembly (38), tending to rotate it in a counter clockwise direction.

Since surface (F) on Cam (46) has now passed over roller (E) on Key Stem (47), Assembly (38) can now rotate counter clockwise under tension of Spring (42) until ear (A)

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on Lever (35) blocks against surface (B) on Latch (37). This latched position of Assembly (38) is its operating position throughout the division cycle. It should be noted here that roller (E) is slightly below surface (G) on Cam (46) and that Assembly (38) is still under slight spring tension in a counter clockwise direction. Therefore, if Latch (37) (surface B) is removed (see paragraph D-3); Assembly (38) can rotate counter clockwise until roller (E) contacts surface (G) on Cam (46). This is far enough to prevent surface (B) on Latch (37) from relatching under ear (A) on Lever (35). Continuation of the division cycle will restore Assembly (38) and connecting linkage to its normal rest position to complete the division operation.

2. Positions Reverse Setting Link.

(Fig. 4). Roller (A) on Lever (48) contacts surface (B) on Lever (49) which rocks it counter clockwise bringing ear (C) against surface (D) on Bail (50), rocking it clockwise.

As the lower end of Bail (50) moves forward it moves Bar (51) into position to cause minus actuation. (See Paragraph 55, Page 27 of Consolidated Service Instructions).

3. Controls Automatic Shift.

(Fig. 5). Roller (B) on Lever (54) cams Interponent (52) counter clockwise. Lever (52) has a slotted end which engages Eccentric Stud (A) on Bell Crank (53). Shelf (G) on Bell Crank (53) is thus lifted and holds Link (57) in non-shift position; as shown, so that notch (H) on Link (57) cannot be engaged by ear (I) on Lever (58). Restore of Lever (54) later in the division cycle will release Link (57), and allow notch (H) to engage ear (I) on Lever (58) for an automatic left shift to the next carriage order.

4. Positions Division Last Position Release Link.

(Fig. 5). Lever (54) carries Link (55) rearward which positions surface (D) to the rear of form (E) on Bail

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(56). This allows surface (C) to be lowered and held against stud (F) on the Left Control Frame when the Carriage reaches its leftmost order. See Paragraph D for end order termination of Division.

5. Positions Division Positioning Arm (T-Member).

(Fig. 1). Stud (J) on Lever (5) operates the same as Stud (71), Figure 122 Page 105. See Paragraph 218 Page 105 of Consolidated Service Instructions.

6. Conditions for Setting Clutch Opening.

(Fig. 1). Clockwise rotation of Lever (5) sweeps surface (I) over stud on Arm (11). Surface (H) on Arm (11) rotates Bail (10) clockwise and moves its left arm from under ear (G) on Lever (9). Lever (9) under tension of Spring (12) is now free to rock counter clockwise and raise Lever (13) thus opening the Setting Clutch as explained in Paragraph 169 and 170 on Page 84 of Consolidated Service Instructions.

(Fig. 9). When Lever (106) is released (see B-6) stud (B) on Lever (106) rotates Lever (110) clockwise. Upper arm of Lever (110) contacts Lever (109) at surface (A) rocking it clockwise. The rocking of Lever (109) clockwise closes the Switch Points as described in Paragraph 38, Page 19 of Consolidated Service Instruction. However, if the Upper Dial Clear operation precedes Division as it normally does (see Paragraph C-5 for exceptions and operation), Lever (107) is delayed from entering ratchet on Idler (108) as follows: Lever (111) blocks clockwise rotation of Assembly (109). Ear (A) on Assembly (109) blocks Lever (110) which blocks stud (B) on Lever (106). Lever (106) is thus blocked from lifting Lever (107) into ratchet on Idler (108) until Lever (111) is removed from behind roller (C) on Lever (109). It is important to note here that when Lever (109) is blocked, ear (D) on Lever (106) has dropped below the top surface of Bail (102) and is therefore



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conditioned to start the Setting Clutch the instant Lever (109) is unblocked.

(Fig. 1). Lever (9) is relatched on Bail (10) by action of Link (16). For action of Link (16) see Paragraph 184 Page 90, Consolidated Service Instruction (part no. 84). As Link (16) moves downward Stud (15) cams Lever (14) counter clockwise. Lower surface of Lever (14) contacts stud (R) on Lever (9) rocking Lever (9) clockwise. This allows Bail (10) to rock clockwise and relatch forward ear of Lever (9).

C. Division Pinning Assembly

(Fig. 3). Assembly (38) is connected to Lever (35) by Link (36) and is rocked to its full clockwise position simultaneous with Lever (35). The various functions performed by the two Arms of Assembly (38) (Arm (45) left and (39) right) are therefore occurring at the same time or slightly before the functions explained in Paragraph A and B. Upon clockwise rotation of Assembly (38), Arm (45) functions as explained in Paragraph

1, 2, 3, and 4 and Arm (39) as explained in Paragraph 5, 6, 7 and 8.

1. Disables Shift Latch and Tabulator Control. (Explained in Paragraph A-2).

2. Disables Line-Up Shift Initiation. (Line-up Key not depressed).

(Fig. 6). As Arm (60) rotates clockwise it moves Lever (63) (pivoted on Arm (60)) clockwise. Stud (A) on Key Stem (62) operates in slot of Lever (63) and controls the position of tip (J) of Lever (63). With Key Stem (62) in the rest (up) position as shown, tip (J) of Lever (63) will be moved to position (L) (shown dotted). As tip (J) on Lever (63) moves to position (L) it contacts form (K) of Lever (70) and rapidly rotates the top of Lever (70) forward, out of the path of ear (E) on Arm (60). Ear (E) will therefore miss the top of Lever (70) and no line-up shift will occur.

3. Positions Line-up Holding Pawl.

(Fig. 6). As Lever (60) rotates clockwise, stud (H) on Pawl (72)



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follows ear (I) on Arm (60) under tension of Spring (71) until ear (G) on Pawl (72) comes to rest in front of one of the teeth on Segment (67). Pawl (72) is now in position to hold Segment (67) in its proper position during line-up count out as explained in Section IIIA Paragraph D-1.

4. Releases Division Stop Link Guide.

(Fig. 6). Clockwise rotation of Arm (60) moves its forward arm away from ear (B) on Guide (65). Link (66) which is spring urged up against the form of Guide (65) will rotate Guide (65) until ear (C) contacts surface (D) of Latch (64), whose position will now control the vertical position of Link (66).

5. Opens Upper Dial Clear Clutch.

(Fig. 7). Clockwise rotation of Arm (79) brings stud (A) on Arm (79) against the tip of Link (81). This moves Link (80) forward initiating an upper dial clearance as explained in Paragraph 86 and 87 page 43, and Paragraph 195 Page 94 of Consolidated

Service Instructions.

If the Upper Dial Lock Key is latched (Section XV, Paragraph C), or the Counter Control Knob is set at Minus or Non-Entry (Section XVI Paragraph C), Link (81) is held up out of the path of stud (A) on Arm (79) and no upper dial clearance occurs.

6. Disables Counter Return Lever.

(Fig. 7). As Arm (79) rotates clockwise ear (I) contacts surface (H) on Lever (78) which lifts surface (F) above stud (G) on Reverse Control (87). See Section XVI Page 1296 for full explanation of counter operations.

7. Conditions Machine for Automatic Clearance and Return to Decimal Position after Division.

(Fig. 7). Clockwise rotation of Arm (79) carries tip (E) of Live Tip (85) below ear (D) on Link (86). Live Tip (85) is then in position to engage ear (D) upon termination of Division (Section II Paragraph D-6).

DIVISION

8. Provides Line-Up Shift Block.

(Fig. 7). Attached to lower arm of Arm (79) is an adjustable Ear (82). Ear (C) on Ear (82) blocks against ear (B) on Arm (83) to delay the start of Division during a Line-Up shift (see Section IIA Paragraph C-3).

D. End Order Termination

1. Shift Direction Control.

(Fig. 8). As the Carriage shifts in to the leftmost position in Division, surface (A) on End Plate (92) cams Lever (88) counter clockwise. Ear (B) on Lever (88) contacts an ear on Interponent (89), rocking it counter clockwise. Surface (C) on Interponent (89) contacts a stud on Interponent (90), rocking it clockwise, bringing surface (D) into right shift position, to rear of ear on Lever (91). The next automatic division shift will therefore be to the right. This positioning of the Shift Direction Control is necessary to insure the correct shift direction in the event no Decimal Key is depressed or the Division Key is held depressed.

2. Unlatching Division Pinning Assembly.

(Fig. 9). Counter clockwise rotation of Lever (93) lowers surface (E) on Link (96) against stud (F) on the Left Control Frame. Lever (93) and Link (96) are yieldably connected to allow Lever (93) to be rocked counter clockwise when the Carriage is shifted into the leftmost position during other operations when Link (96) is forward.

The lowering of Link (96) against stud (F) places surface (G) in position to contact surface (H) of Bail (97) as Link (96) is moved forward during restore of Lever (103).

(Fig. 10). As Lever (119) is restored counter clockwise at the termination of division, it is latched by Latch (115) whose surface (E) drops in front of roller (F) on Lever (119).

(Fig. 9). As Link (96) moves forward surface (G) contacts form (H) on Bail (97)



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and rocks Bail (97) counter clockwise until the rearward portion of surface (E) on Lever (96) contacts stud (F). This lifts Lever (96) and causes surface (G) to release Bail (97) allowing it to return to its normal position. As Bail (97) is being rocked counter clockwise it carries Link (101) rearward. As Link (101) starts rearward ear (I) contacts surface (J) on Latch (99) and rocks surface (K) from under ear (L) on Assembly (98).

Note that as Link (101) moves rearward tip (M) passes under ear (N) on Latch (105), and that the end order termination is the equivalent of a single depression of the Stop Key, Paragraph 256 and 257, Page 123 of Consolidated Service Instructions.

3. Restore of Division Pinning Assembly.

(Fig. 10). As surface (L) on Latch (121) is removed from under ear (M), Assembly (120) will rock slightly counter clockwise, due to light ten-

sion of Spring (126), (see end of Paragraph B-1) and Latch (121) will then be prevented from relatching ear (M) on Assembly (120). As the Setting Line continues to rotate, Interlock (127) rocks counter clockwise, putting heavy tension on Spring (126) which rotates Assembly (123) counter clockwise to its home position.

4. Restore of Division Key.

(Fig. 10). Counter clockwise rotation of Assembly (123) to its home position rotates Assembly (120) counter clockwise which carries Key Stem (118) upward. As Key Stem (118) moves up it moves roller (I) in front of surface (J) of Lever (119). As roller (I) is being positioned in front of surface (J), ear (H) on Key Stem (118) has contacted surface (G) on Latch (115) and unlatched Lever (119) which moves rearward to rest against roller (I). Upward movement of Key Stem (118) also brings surface (D) against stud (C) on Link (117), rocking it upward until sur-



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face (B) is stopped by ear (A) on Key Stem (116). Key Stem (116) is now held in its "up" position with surface (K) blocking against stud (L) in the Left Control Frame.

5. Return to Decimal Key Control.

(Fig. 2). As Arm (32) rotates counter clockwise to its home position, it moves the ear on Lever (20) away from surface (A) on Lever (21), which allows Link (23) to be returned to engagement with Lever (22). See Section C, Paragraph 7, Page 1283, for detailed explanation of re-engagement of Link (23) with Lever (22).

Counter clockwise rotation of Arm (32) also moves Link (25) rearward, removing surface (G) from stud (H) on Lever (22) and removing roller (F) from surface (J) on Lever (24). All parts of the Decimal Shift Mechanism are now engaged for normal operation.

6. Automatic Clear and Return.

(Fig. 11). The Automatic Clear and Return mechanism always functions at

the termination of Division whether in the end order or upon stop key depression. As Arm (128) is restored counter clockwise during the last carriage dip in Division, Link (135) moves Link (138) forward until ear (J) overlies surface (H) of Live Tip (134). The forward end of Link (138) is thus lifted until surface (B) is behind ear (A) on Lever (130).

The forward movement of Link (138) also moves surface (E) away from ear (D) on Interlock (132). Interlock (132) is thus rotated by Spring (131) until ear (D) stops against surface (C) of the Right Side Frame. In this position tip (F) of Interlock (132) is over ear (G) of Bail (133) and will therefore delay the shift clutch opening until Link (138) moves completely rearward. This delay is necessary to allow the Carriage to clear before the shift is started.

As the last restore cycle of the setting line begins, Link (135) moves rearward carrying Link (138),



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which begins to move Lever (130) clockwise to open the Middle Dial Clear Clutch. However, clockwise movement of Lever (130) is prevented because the middle dial clearance is blocked during setting clutch rotation (Paragraph 299, Page 146 of Consolidated Service Instructions). Therefore, stud (K) on Link (135) moves away from surface (L) on Link (138) putting heavy tension on Lever (130) through Spring (137), which normally holds surface (L) on Link (138) against stud (K) on Link (135).

As Link (135) is moving rearward an automatic right shift is also being initiated. It is necessary to delay this shift clutch opening until the setting clutch closes and upper dial clearance is complete. The initial delay is provided by ear (G) on Bail (133) blocking against tip (F) on Interlock (132).

(Fig. 12). This block is removed after the middle dial clear clutch opens but Dog (140) is then blocked

by roller (A) on Assembly (141), stopping against surface (B) on Lever (139). Therefore, return of the Carriage to the depressed Decimal Key (rightmost position if no Key is depressed) is delayed until middle dial clearance is complete.

(Fig. 11). When Link (135) reaches its rearmost position, the Setting Clutch has closed and the Middle Dial Clear Clutch is free to open. Link (138) now moves rearward by Spring (137) and rotates Lever (130) fully clockwise.

(Fig. 13). As Lever (146) rotates clockwise it pulls Link (142) rearward. Rearward movement of Link (142) rotates Bail (143) clockwise to clear the Keyboard, open the Middle Dial Clear Clutch and return the Counter Control Knob from Minus to Non-entry. Clockwise rotation of Bail (143) brings surface (A) on the left arm against stud (B) on Bail (144) to clear the Keyboard selectively. (No clearance if Key-



DIVISION

board Lock Key is depressed). Stud (C) on the right arm of Bail (143) contacts arm (D) of Sector (145), (Counter Control Knob set at minus) and moves Sector (145) counter clockwise to the X-NE notch.

(Fig. 14). Clockwise rotation of Bail (149) also rocks Assembly (148) (surface A) clockwise. Live Tip (147) on Assembly (148) contacts stud (B) on Bail (150) (Middle Dial Lock Key not depressed) clearing the Middle Dials.

(Fig. 15). As Link (152) moves to the rear under tension of Spring (151), surface (A) contacts Eccentric Stud (165) on the Right Side Frame and the forward end of Link (152) is moved downward as well as rearward until surface (D) on Link (152) comes to rest against stud (C) on Link (164).

(Fig. 15). The rearward and downward movement of Link (152) moves surface (E) against ear (F) on Interlock (156) which moves tip (G) forward and re-

leases ear (H) on Bail (159). This allows the shift to be initiated immediately following the clear operation. At the same time ear (I) on Link (152) has moved rearward past the edge of tip (J) on Live Tip (161) and the downward movement of Link (152) will not rotate Assembly (157) out of home position.

SECTION IIA LINE-UP

Depression of the Line-Up Key simultaneous with the Division Key will initiate a right carriage shift unless the Control Knob is at "0" or the Carriage is in its rightmost position. (In which case Division will start immediately). When a Line-Up Shift is started the Carriage will shift the number of orders indicated on the Line-Up Control Knob or until the rightmost carriage order is reached. Upon termination of a Line-Up shift Division starts immediately.

A. Line-Up Control Knob

1. (Fig. 16). Control Knob (9) has Cam (3) attached to the left end.

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This cam has six uniform centralizer notches corresponding to the \rightarrow , 5, 4, 3, 2 and 1 position and a special "0" position. Control Knob (9) and all parts are shown in the \rightarrow position. On the opposite edge of Cam (3) are six uniform steps corresponding to the centralized positions. (Note that "0" and "1" are on the same step). Cam (3) is held in position by Lever (8) (stud (A)) resting in a centralizer notch under tension of Spring (2). This centralizer holds the corresponding digit or symbol on Control Knob (9) in correct position in Cover (1) opening. Stud (B) on Lever (4) is held against steps on Cam (3) by Spring (5). Slot (C) on the lower end of Lever (4) engages stud (D) on Segment (6). Thus the movement of Segment (6) is in direct relation to movement of Control Knob (9).

B. Line-Up Disabling

1. Line-Up Control Knob at "0".
(Fig. 17). With Control Knob (10) set at "0", tip (A) on Cam (12) will

move stud (B) on Follower (13) farther than the normal centralized position. This additional clockwise rotation of Follower (13) brings surface (C) against stud (D) on Interponent (14), rocking it counter clockwise. As Interponent (14) rotates counter clockwise, tip (E) contacts stud (F) on Lever (18). Lever (18) rotates counter clockwise about its pivot on Lever (16), which moves tip (G) out of the path of ear (H) on Arm (15). Initiation of a Line-Up shift is thus disabled even though the Line-Up Key may be depressed.

2. Carriage in Rightmost Position.

(Fig. 17). When the Carriage moves into the rightmost position a lug riveted to Carriage Brace (20) (to the left of the no. eight dial) cams Lever (19) clockwise. Ear (J) on Lever (19) contacts surface (K) on Interponent (14) rocking it counter clockwise. Surface (E) on Interponent (14) contacts stud (F) on Lever (18) rocking it counter clockwise. This removes tip (G) of Lever (18) from



DIVISION

the path of ear (H) on Arm (15) thus disabling the Line-Up shift.

C. Initiation of Line-Up.

1. Shift Direction Control & Setting Clutch Opening.

(Fig. 18). Depression of Key (23) lowers stud (A). Stud (A), operating in slot (B) of Lever (24) raises tip (C) of Lever (24) away from form (D) on Lever (33). As Assembly (22) rotates clockwise upon depression of the Division Key (simultaneous with or after depression of Key (23)), ear (E) on Arm (25) contacts tip (F) of Lever (33) moving it downward. Lever (33) being pivoted on Lever (31) rotates Lever (31) clockwise until surface (G) is blocked by the hub on Lever (30). This movement of Lever (31) starts a right shift and also blocks further clockwise movement of Assembly (22) until the Line-Up Shift starts.

Clockwise movement of Lever (31) pulls attached Link (32) downward, which rocks Interponent (35) clockwise through the slotted upper end

engaging stud (H). Interponent (35) is now in a position to engage Lever (34) to initiate a right shift. Stud (I) on Lever (31) pushes on Pin (28), (which is held in position by Spring (27)), and rotates Bail (26) clockwise.

(Fig. 19). As Bail (38) rocks clockwise its left arm, being against ear (A) on Bail (37), rotates Bail (37) clockwise and moves tip (B) on right arm of Bail (37) out of the path of ear (C) on Lever (41). This initiates a setting clutch operation as explained in paragraph 169 and 170, page 84 of Consolidated Service Instructions. Switch opening explained in Section II Paragraph B-6.

2. Blank Setting Cycle & Shift Initiation.

(Fig. 19). Clockwise rotation of Bail (38), in addition to rocking Bail (37) as explained above, also moves surface (D) on its right arm against ear (E) on Lever (39). Surface (F) on Lever (39) is thus removed from the path of ear



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(G) on Lever (40) to allow Lever (40) to disable the opening of the Main Clutch.

(Fig. 20). When Lever (44) is not blocked, rotation of the Setting Line rotates Cam (48) against roller (H) on Arm (46) which rocks Lever (44) clockwise through Yield Spring (45). This positions surface (I) on Lever (44) in position to collapse Lever (49). As Arm (43) is rotated counter clockwise by roller (M) riding Cam (47) it carries Lever (49) upward and leftward. Ear (J) on Lever (49) contacts surface (I) on Lever (44). Tip (K) on Lever (49) moves rapidly downward in time to pass under hook (L) on Dog (50), thus preventing opening of the Main Clutch. By disabling the opening of the Main Clutch the Setting Line makes one complete rotation which allows ear (W) on Lever (27) (Fig. 2) to engage surface (X) on Lever (31) and open the Shift Clutch. One complete rotation of the Setting Clutch without interruption for a Main

Clutch operation will hereafter be referred to as a "Blank Setting Cycle".

3. Removal of Line-Up Block.

(Fig. 18). In all operations explained in Paragraph 1 and 2 above, Assembly (22) was blocked by Lever (33) being under ear (E).

(Fig. 1). In this "Line-Up Block" position roller (B) on Key Stem (3) has moved down just far enough for tip (C) of Lever (5) to almost pass over the top of roller (B). Lever (5) is thus exerting clockwise force on Lever (4).

(Fig. 18). This holds ear (E) on Assembly (22) firmly against Lever (33) until Lever (33) is removed by the initial rotation of the Shift Clutch. In rotating clockwise to the position just described, Assembly (22) has moved far enough, before the Line-Up Shift begins, to open the Middle Dial Clear Clutch, Section II Paragraph C-7, and also to disconnect the shift mechanism from Decimal Key Control (Section II Paragraph A-1).



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(Fig. 2). The shift mechanism must be disconnected from the Decimal Key control before the Lower Carriage starts to rise. This is necessary in order to enable surface (X) on Lever (31) to position in front of ear (W) on Lever (27) before the Carriage rises. The direction of shift and amount of Carriage travel is then controlled by the Line-Up Shift mechanism.

(Fig. 21). As the Shift Clutch engages, Cam (60) rotates and tip (A) on Assembly (59), which normally rests in one of the two notches in Cam (60), is immediately driven counter clockwise. Counter clockwise movement of Assembly (59) causes surface (B) to contact roller (C) and rock Lever (58) counter clockwise against tension of Spring (61). Ear (D) on Lever (58) contacts surface (E) on Lever (51) and rotates tip (F) on Lever (51) out from under ear (G) on Arm (53). With the removal of the Line-Up Block, Arm (53) attempts to rotate

clockwise but ear (H) of Lever (54) on Arm (53) is now blocked by ear (I) on Arm (55). Thus the start of division is delayed until termination of the Line-Up shift. The removal of Lever (51) from under ear (G) on Arm (53) now allows Spring (65) to return Link (63) to its up position with surface (J) resting against Spacer (62). This then frees Interponent (64) from its mandatory right shift position and allows it to position for a normal left shift in Division.

D. Line-Up Count-Out and Shift Termination

1. Line-Up Control Knob shown at "0" position.

(Fig. 22). Each cycle (1/2 turn) of Cam (73) cams the lower end of Follower (75) rearward, moving Link (74) rearward. As Link (74) moves rearward it rocks Lever (72) counter clockwise. Pawl (67) attached to the lower end of Lever (72) and forward end resting on Segment (68) is moved rearward and downward. As Pawl (67)



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moves rearward ear (A) engages one of the teeth on Segment (68) moving Segment (68) clockwise one tooth for each cycle of the Shift. As ear (A) on Pawl (67) moves forward to engage the next tooth on Segment (68), ear (B) on Pawl (66) engages one of the teeth preventing any possible counter clockwise movement of Segment (68).

As Segment (68) rotates clockwise one tooth for each shift cycle the shift is terminated when ear (C) on Segment (68) contacts surface (D) on Lever (70) and rocks it clockwise. As Lever (70) rocks clockwise surface (E) contacts Stud (71) on Lever (69) rocking the rear end of Lever (69) downward out of engagement with Latch Control (78) (Fig. 23), releasing the shift mechanism thus stopping the Shift Clutch.

2. (Fig. 22). The position of Segment (68) is the same for "0" and "1". In the "0" position there will be no Line-Up shift (see Section IIA Paragraph B-1), and in the "1" position

Pawl (67) will rock Segment (68) on the first shift cycle preventing Lever (69) from engaging Latch Control (78) (Fig. 23).

If Segment (68) is positioned for more than five shift cycles (Control Knob at →), Pawl (67) will not engage any teeth on Segment (68), thus the Carriage will shift to the rightmost position.

(Fig. 23). The shift will then be terminated by Finger (83). As the Carriage moves into the rightmost position Finger (83) contacts Live Tip (82) rocking Trip Lever (81) clockwise, which rocks Bell Crank (80) counter clockwise. Ear (A) on forward end of Bell Crank (80) contacts stud (B) on Lever (79) lowering the rear end out of engagement with Latch Control (78), terminating the shift. Any time the Carriage shifts into the rightmost position, regardless of where the Control Knob is positioned, the shift will be terminated as just described.

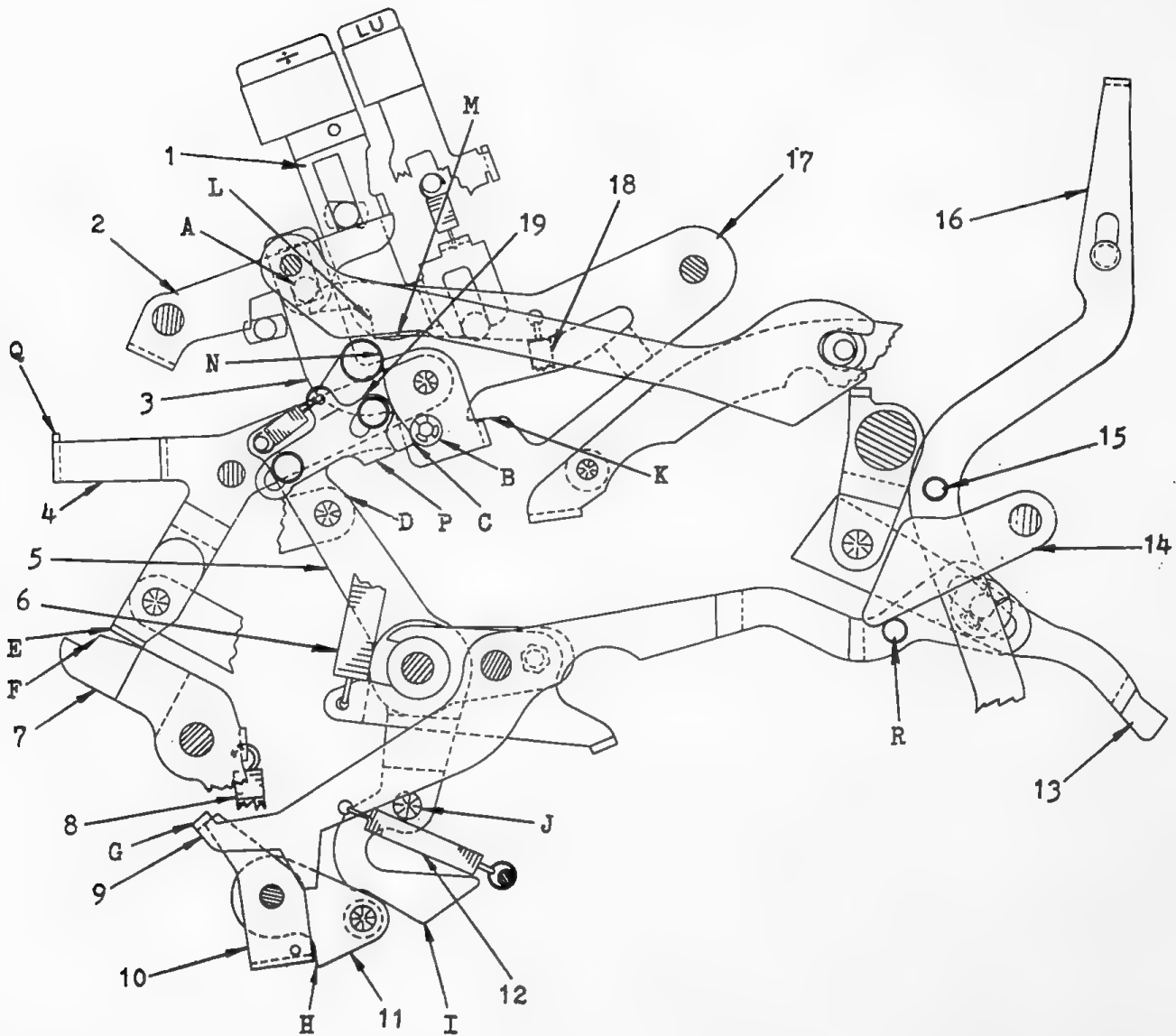


FIG. 1

- | | |
|--|---|
| 1. Division Key-39321A | 11. Division Starting Arm-38822 |
| 2. Division Key Link-39715A | 12. Spring-7157 |
| 3. Division Key Stem-39707* on 39320D | 13. Setting Clutch Opening Lever-36695A |
| 4. Division Interlock Lever-39339* on 39320D | 14. Starting Control Restore Lever-38176 |
| 5. Division Operating Lever-38885A | 15. Stud-38173* on 38172 |
| 6. Spring-7624 | 16. Mult. Trip Pawl Release Link-38172 |
| 7. Division Key Latch-38327 | 17. Division Operating Lever Latch-38404A |
| 8. Spring-7785 | 18. Spring-7027 |
| 9. Starting Control Lever-38780B | 19. Division Key Latching Cam-37393A* on 38885A |
| 10. Setting Clutch Opening Bail-38715 | |

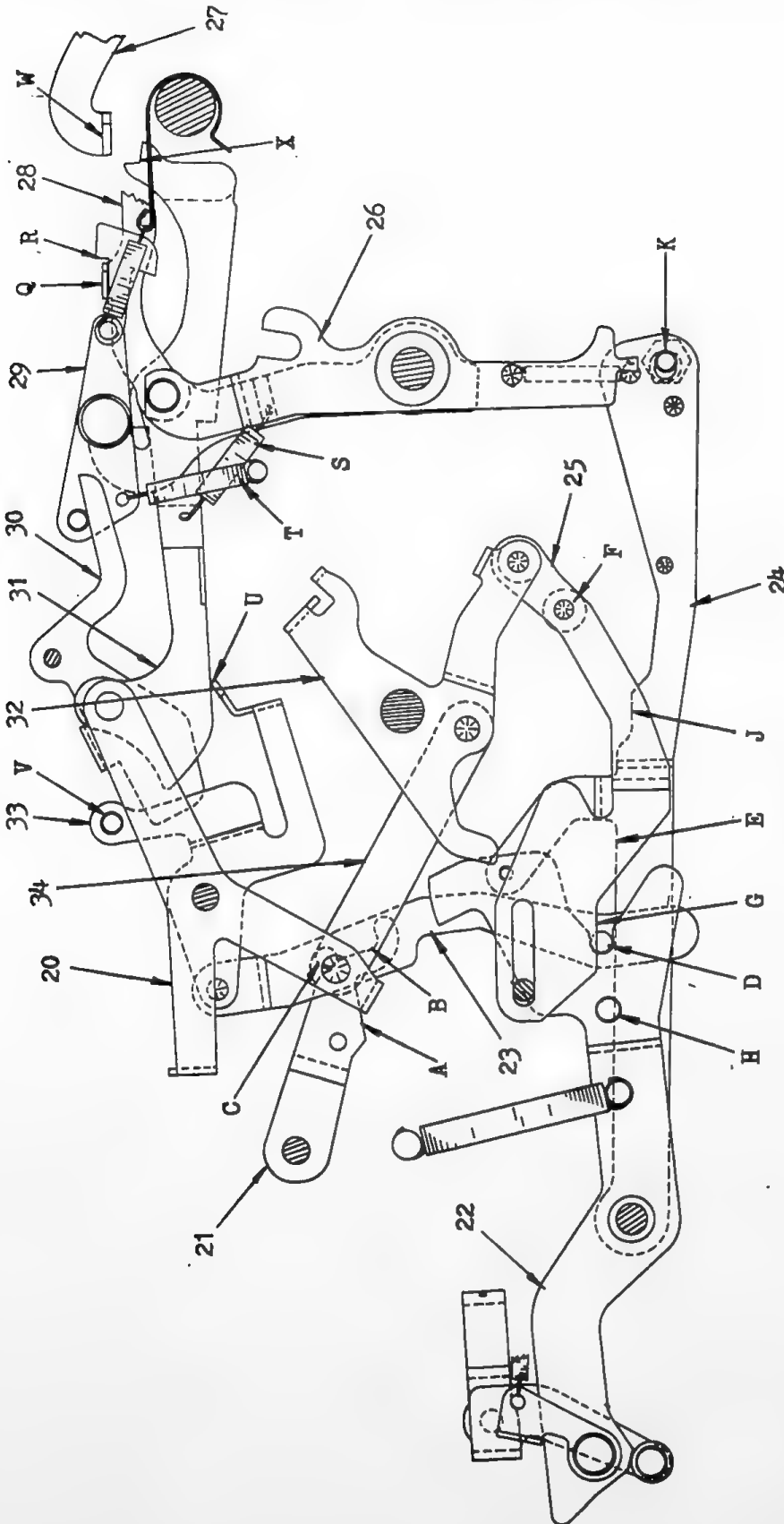


FIG. 2

- 20. Division Interlock Lever-39339* on 39320D
- 21. Tab Division Disabling Lever-38806
- 22. Tab Control Lever-38905
- 23. Tab Shift Direction Link-38850
- 24. Shift Latch Lever-38775
- 25. Division Tab Interlock Link-38630
- 26. Shift Latch Control-38785B
- 27. Shift Drive Lever-38383
- 28. Shift Control Link-72382B* on 38785B
- 29. Shift Positioning Interponent-38960A* on 38950A
- 30. Shift Direction Interponent-38985
- 31. Auto Shift Control Link-38955* on 38950A
- 32. Division Interlock Arm-38935* on 38080
- 33. Shift Selection Link-38855B
- 34. Division Counter Control Link-37117* on 39320D

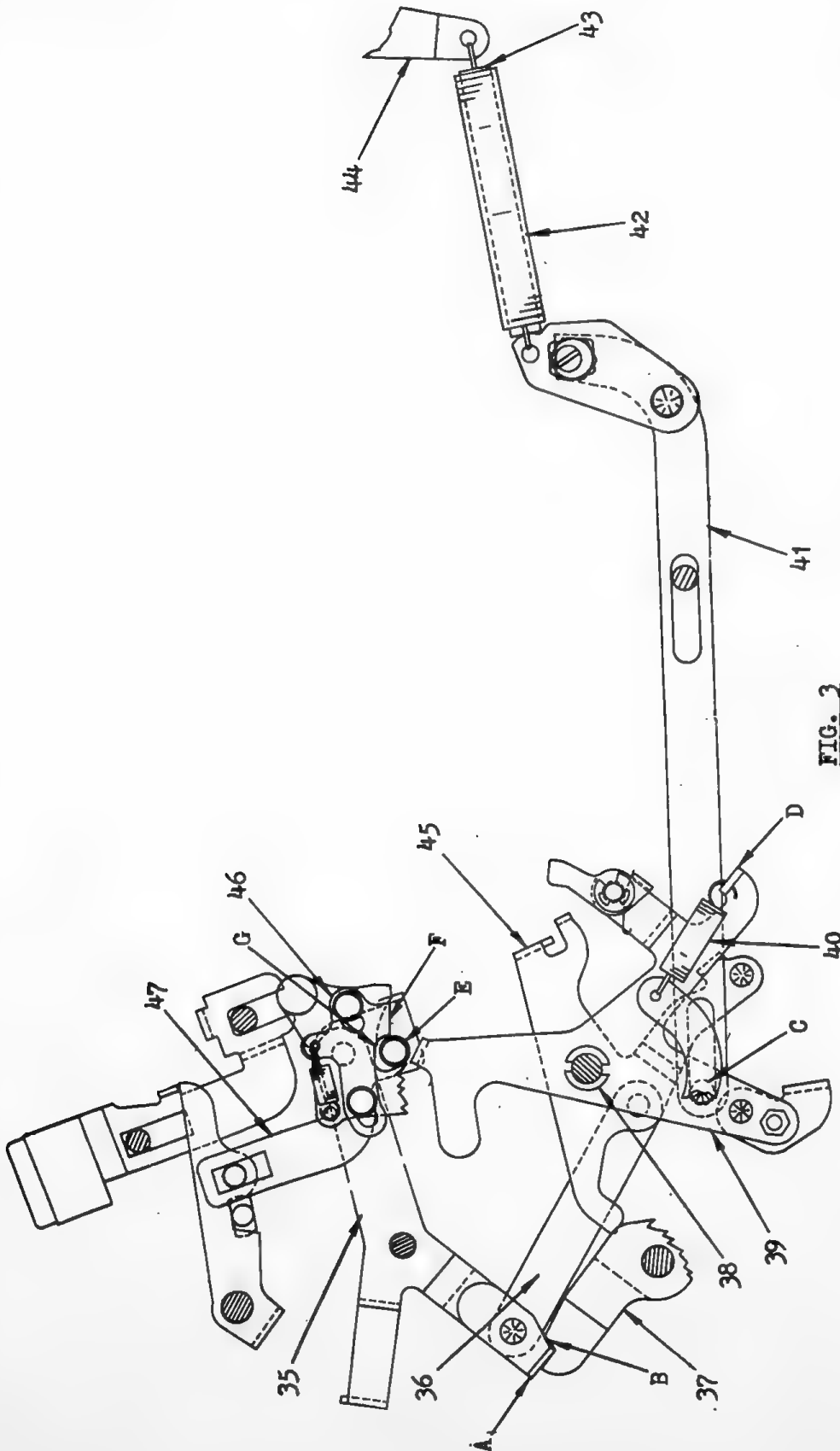


FIG. 2

- 35. Division Interlock Lever-39339* on 39320D
- 36. Division Counter Control Link-37117* on 39320D
- 37. Division Key Latch-38327
- 38. Division Counter Control Assembly-38080
- 39. Division Counter Reverse Arm-38175* on 38080
- 40. Spring-7612
- 41. Division Key Return Link-38180
- 42. Spring-7628
- 43. Stop Pin-39938
- 44. Starting Switch Interlock-38050
- 45. Division Interlock Arm-38935* on 38080
- 46. Division Key Latching Cam-37393A* on 38885A
- 47. Division Key Stem-39707* on 39320D

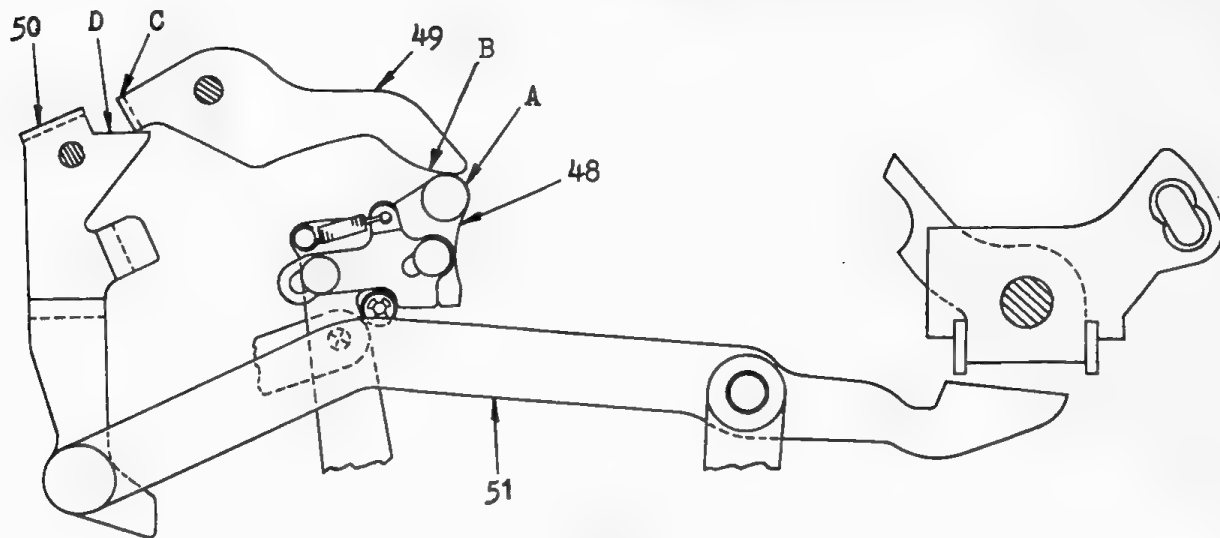


FIG. 4

48. Division Operating Lever-38885
 49. Division Minus Setting Lever-39260

50. Reverse Setting Bail-39317A
 51. Reverse Setting Bar-38035A

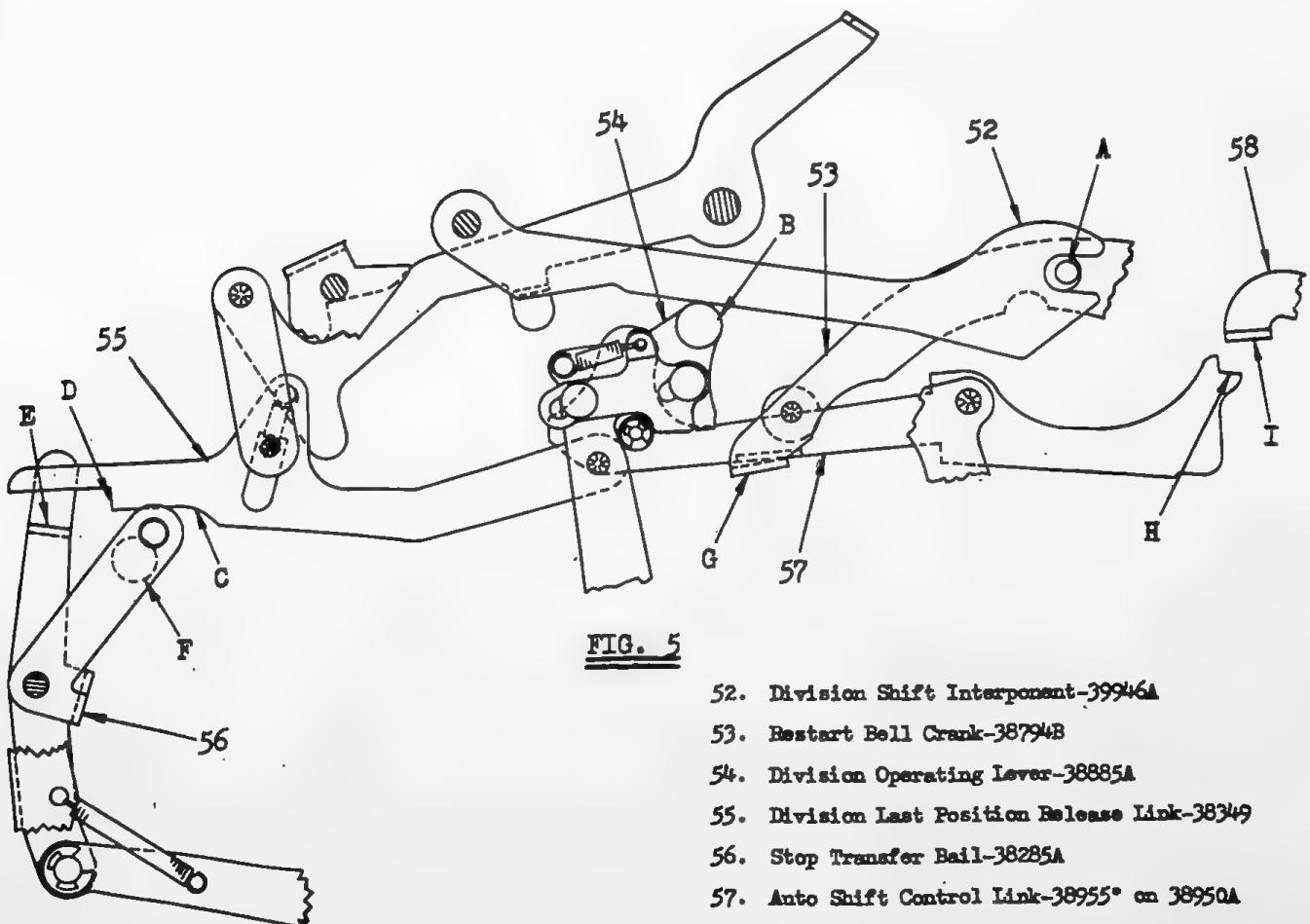


FIG. 5

52. Division Shift Interponent-39946A
 53. Restart Bell Crank-38794B
 54. Division Operating Lever-38885A
 55. Division Last Position Release Link-38349
 56. Stop Transfer Bail-38285A
 57. Auto Shift Control Link-38955° on 38950A
 58. Shift Drive Lever-38383

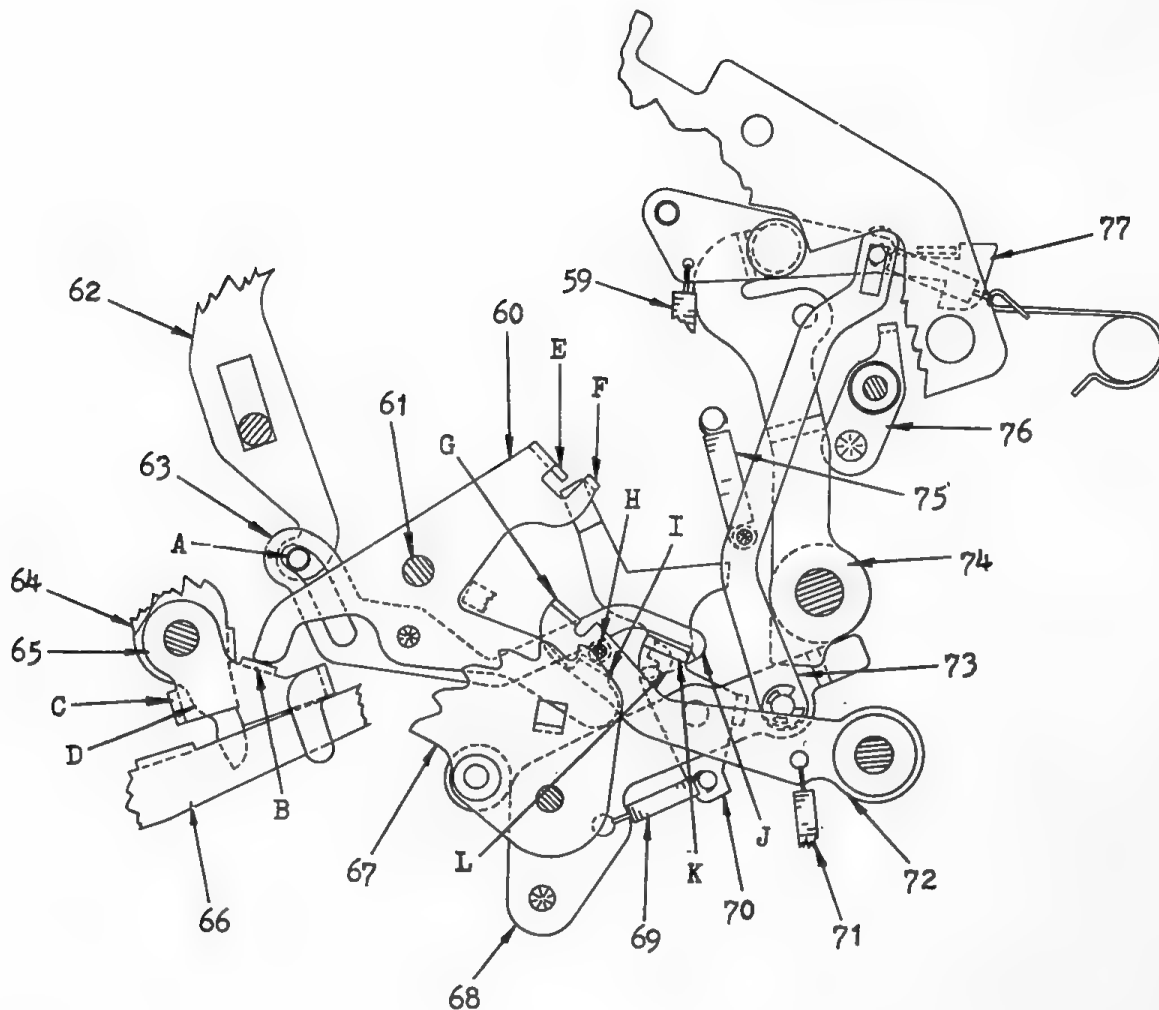


FIG. 6

- | | |
|--|---|
| 59. Spring-7239 | 69. Spring-7009 |
| 60. Division Interlock Arm-38935* on 38080 | 70. Division Pinning Blocking Lever-39205* on 39215 |
| 61. Division Counter Control Assembly-38080 | 71. Spring-7017 |
| 62. Line-Up Key Stem-38990 | 72. Line-Up Holding Pawl-39237A |
| 63. Division Pinning Block Disabling Lever-36024 | 73. Line-Up Shift Link-39614 |
| 64. Division Key Latch-38327 | 74. Automatic Shift Control Lever-38950A |
| 65. Division Stop Link Guide-38312 | 75. Spring-7276 |
| 66. Division Stop Link-38389A | 76. Right Shift Lever-38695C* on 38700C |
| 67. Line-Up Selection Count Out Segment-39180A | 77. Shift Positioning Interponent-38960A* on 38950A |
| 68. Line-Up Shift Lever-38760* on 39215 | |

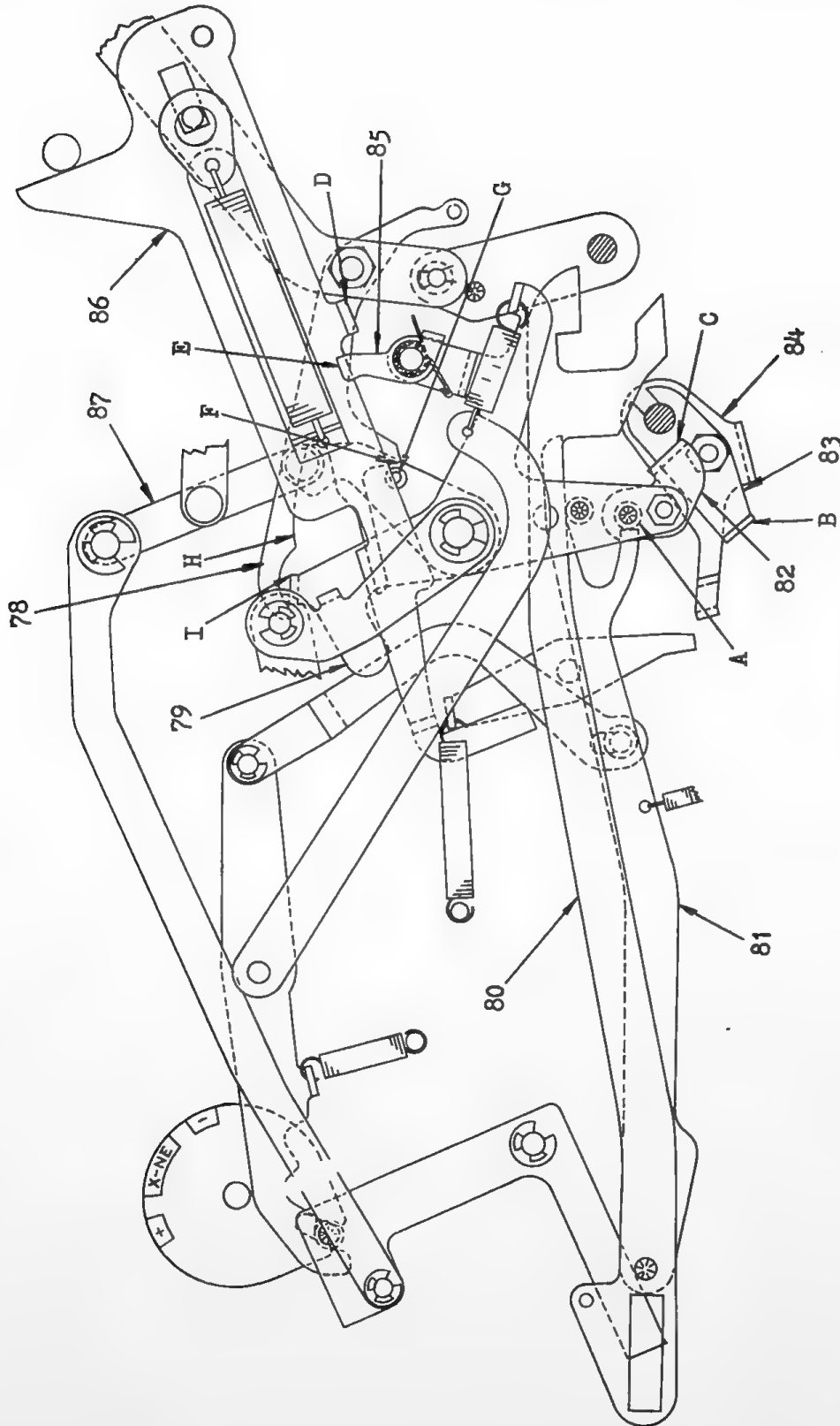


FIG. 7

- 78. Counter Return Lever-67093A
- 79. Division Counter Reverse Arm-38175° on 38080
- 80. Counter Clear Release Link-38741° on 39090
- 81. Counter Division Operated Release Link-39091° on 39090
- 82. Adjustable Division Counter Reverse Bar-36259
- 83. Division Line-Up Shift Interlock Arm-38821
- 84. Shift Interlock Bail-38837A
- 85. Post Division Clear Live Tip-38068
- 86. Post Division Clear Link-Short-38125
- 87. Counter Reverse Control-38015

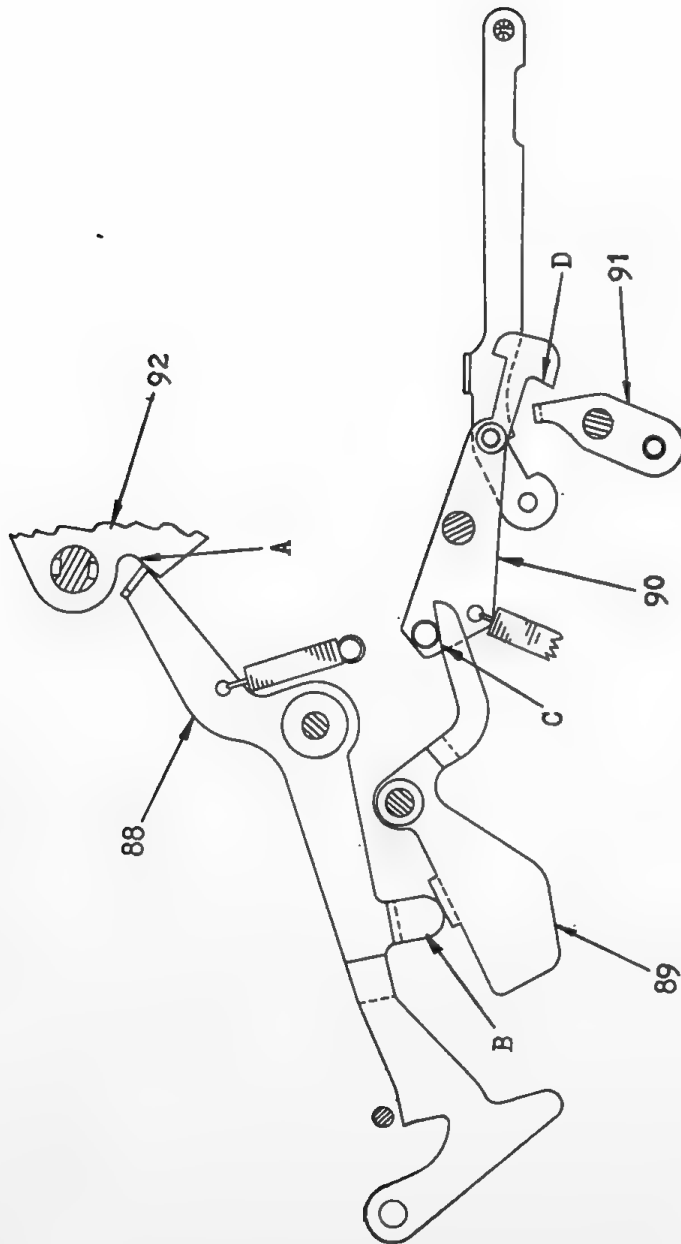


FIG. 8

- 88. Last Position Div Stop Lever-38880A
- 89. Shift Direction Interponent-38985
- 90. Shift Positioning Interponent-38960A on 38950A
- 91. Right Shift Lever-38965C on 38700C
- 92. Carriage End Plate-Right-93039A

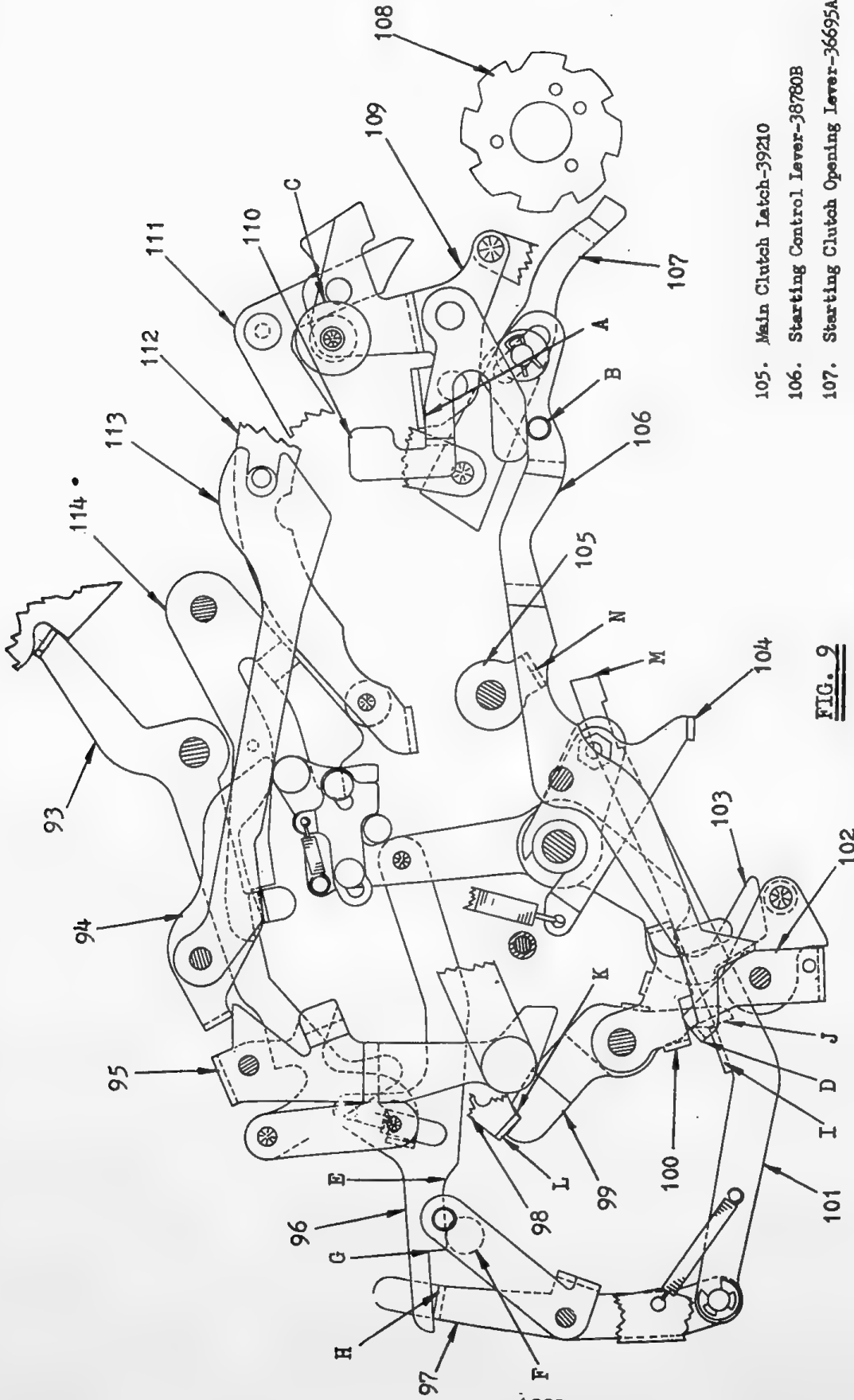


FIG. 2

- | | | |
|---|---|--|
| 93. Last Position Stop Lever-38880A | 99. Division Key Latch-38327 | 105. Main Clutch Latch-39210 |
| 94. Division Mimus Setting Lever-39260 | 100. Division Stop Link Guide-38312 | 106. Starting Control Lever-38780B |
| 95. Reverse Setting Bail-39317A | 101. Division Stop Link-38389A | 107. Starting Clutch Opening Lever-36695A |
| 96. Division Last Position Release Link-38349 | 102. Setting Clutch Opening Bail-38715 | 108. Restore Drive Idler-57505 |
| 97. Stop Transfer Bail-38285A | 103. Division Operating Lever-38885A | 109. Switch Control Lever-38089 |
| 98. Division Key Assembly-39320D | 104. Division Operating Lever Adjusting Arm-38497 | 110. Clear Interlock Operating Lever-38090 |
| | | 111. Counter Clear Release Lever-57035C |
| | | 112. Restart Bell Crank-38794B |
| | | 113. Division Shift Interponent-39946A |
| | | 114. Division Operating Lever Latch-38404A |

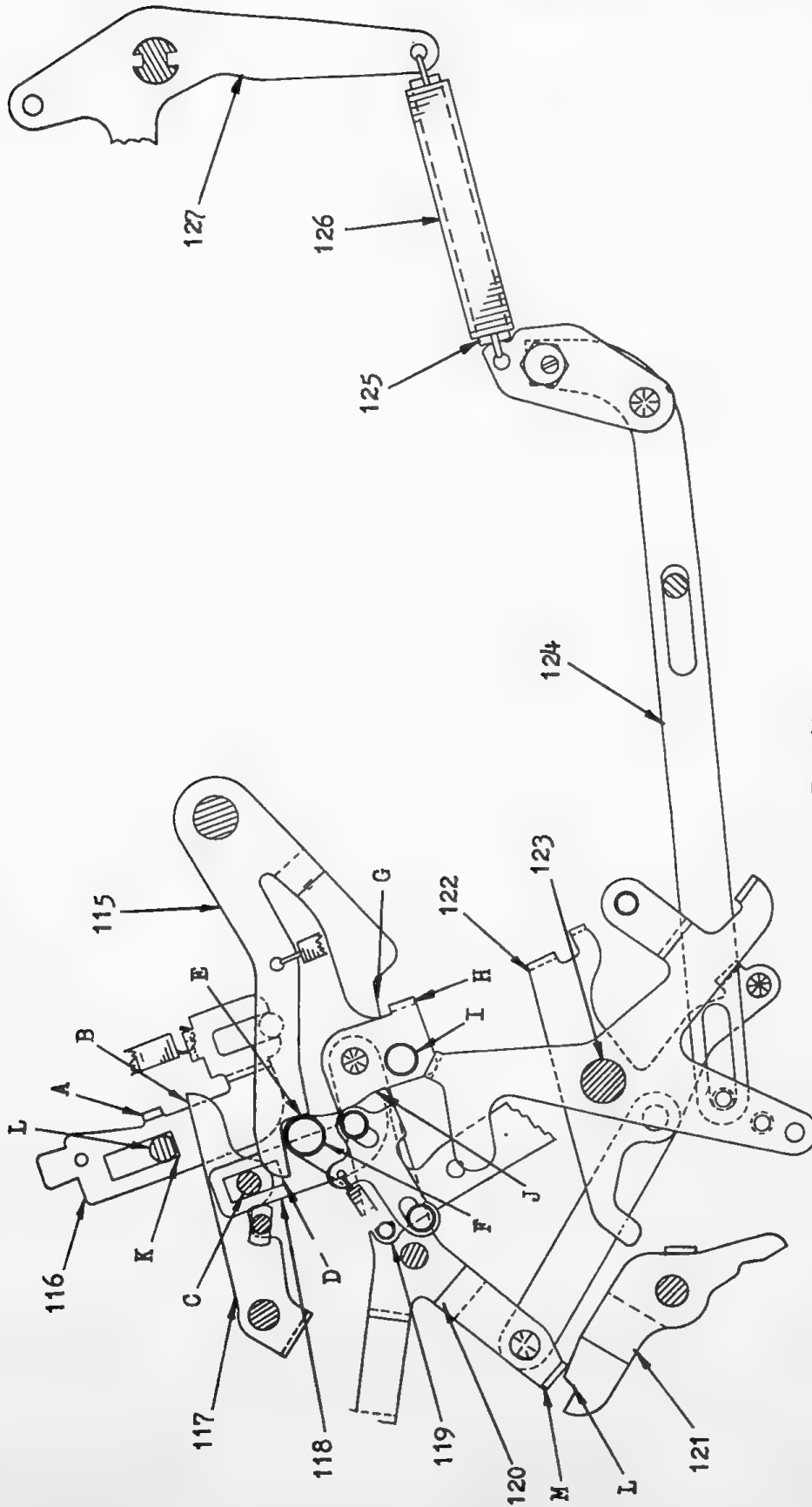


FIG. 10

- 115. Division Operating Lever Latch-38404A
- 116. Division Key Stem-Upper-39321A
- 117. Division Key Link-39715A
- 118. Division Key Stem-Lower-39707A* on 39320D
- 119. Division Operating Lever-38885A
- 120. Division Key Assembly-39320
- 121. Division Key Latch-38327
- 122. Division Line-Up, Stop, and Interlock Arm-38935* on 38080
- 123. Division Counter Control Shaft Assembly-38080
- 124. Division Key Return Link-38180
- 125. Division Key Return Spring Stop Pin-39938
- 126. Spring-7628
- 127. Starting Switch Interlock-38050

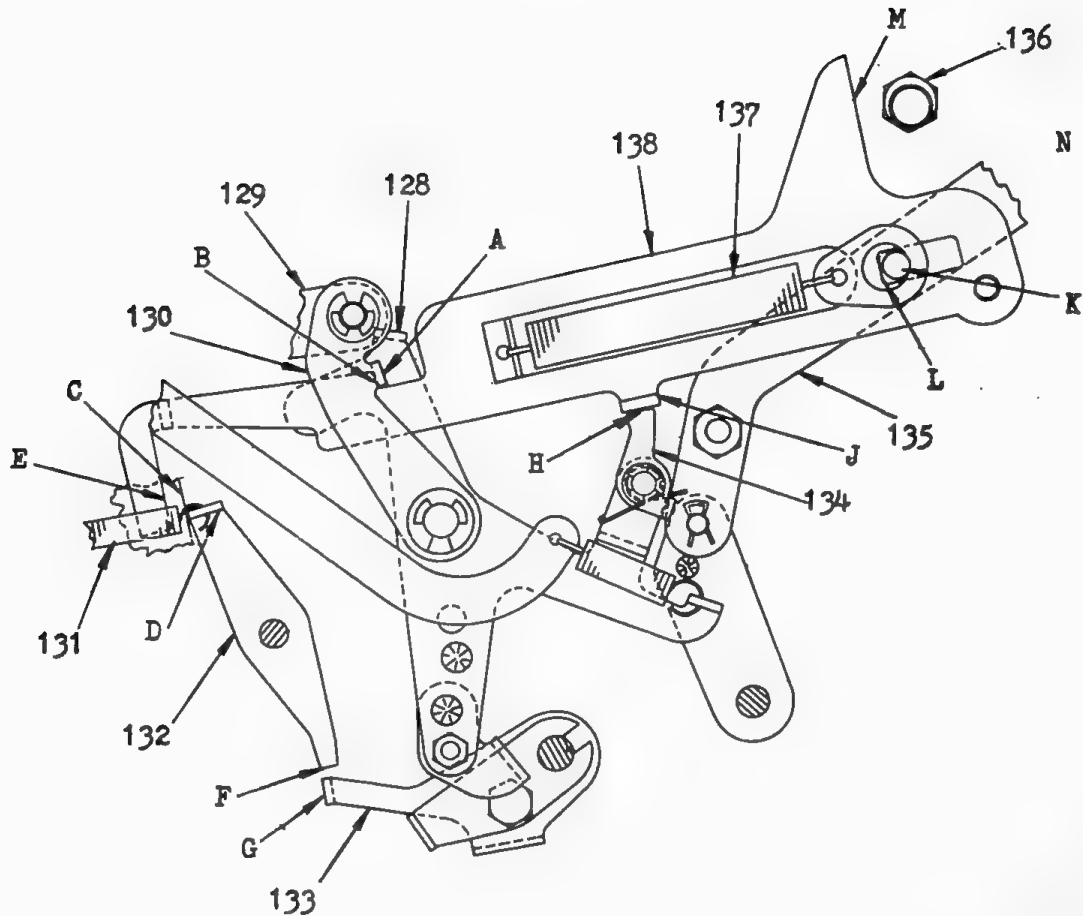


FIG. 11

- 128. Division Counter Reverse Arm-38175* on 38080
- 129. Post Division Clear Link-Long-38070
- 130. Post Division Clear Lever-38085
- 131. Spring-7030
- 132. Post Division Interlock-38075A
- 133. Shift Interlock Bail-38837A
- 134. Post Division Clear Live Tip-38068
- 135. Dip Sensing Link-38041
- 136. Main Clutch Spring Stud Nut-38103
- 137. Spring-7677
- 138. Post Division Clear Link-Short-38125

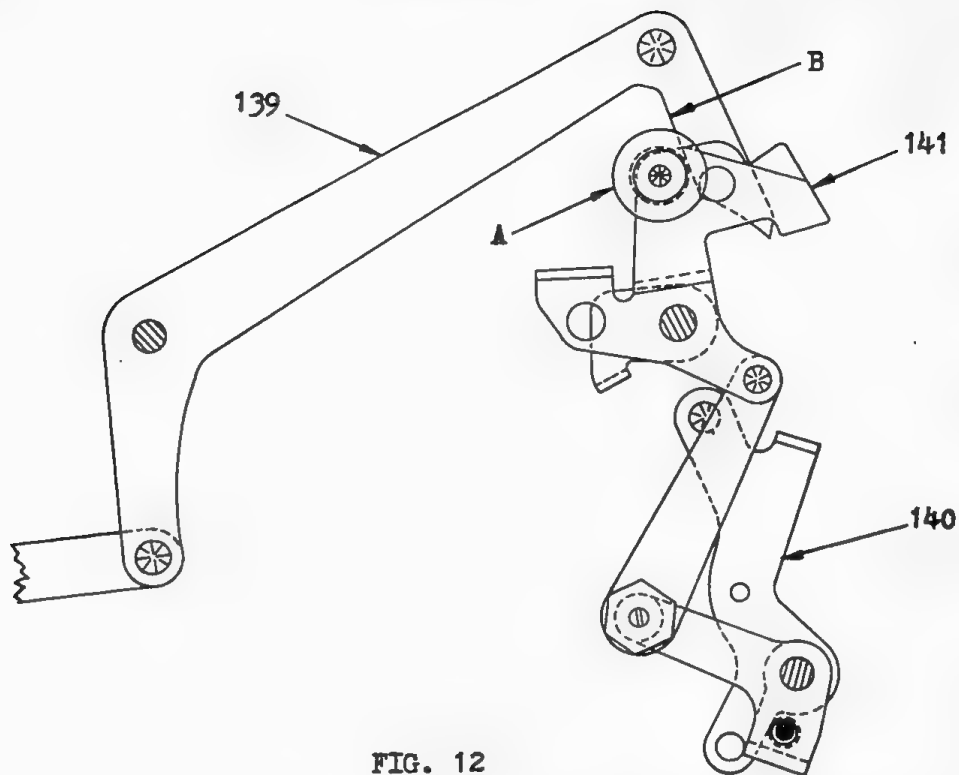


FIG. 12

- 139. Product Clear Release Lever-39538* on 39537A
- 140. Shift Clutch Release Dog-72335B
- 141. Switch Control Lever-38089A

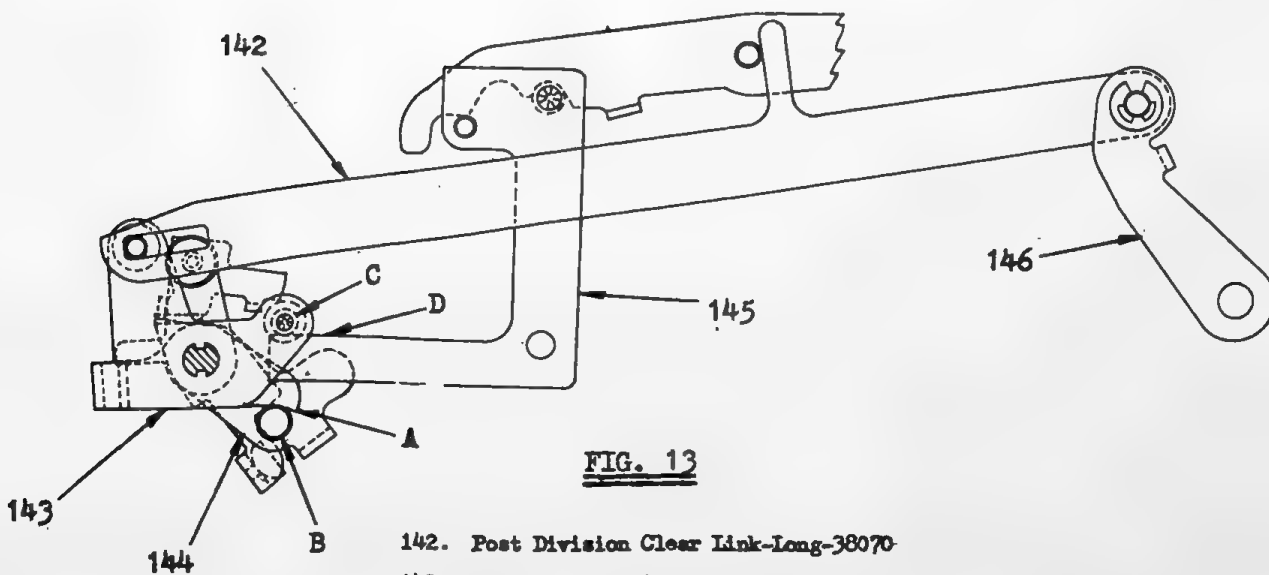
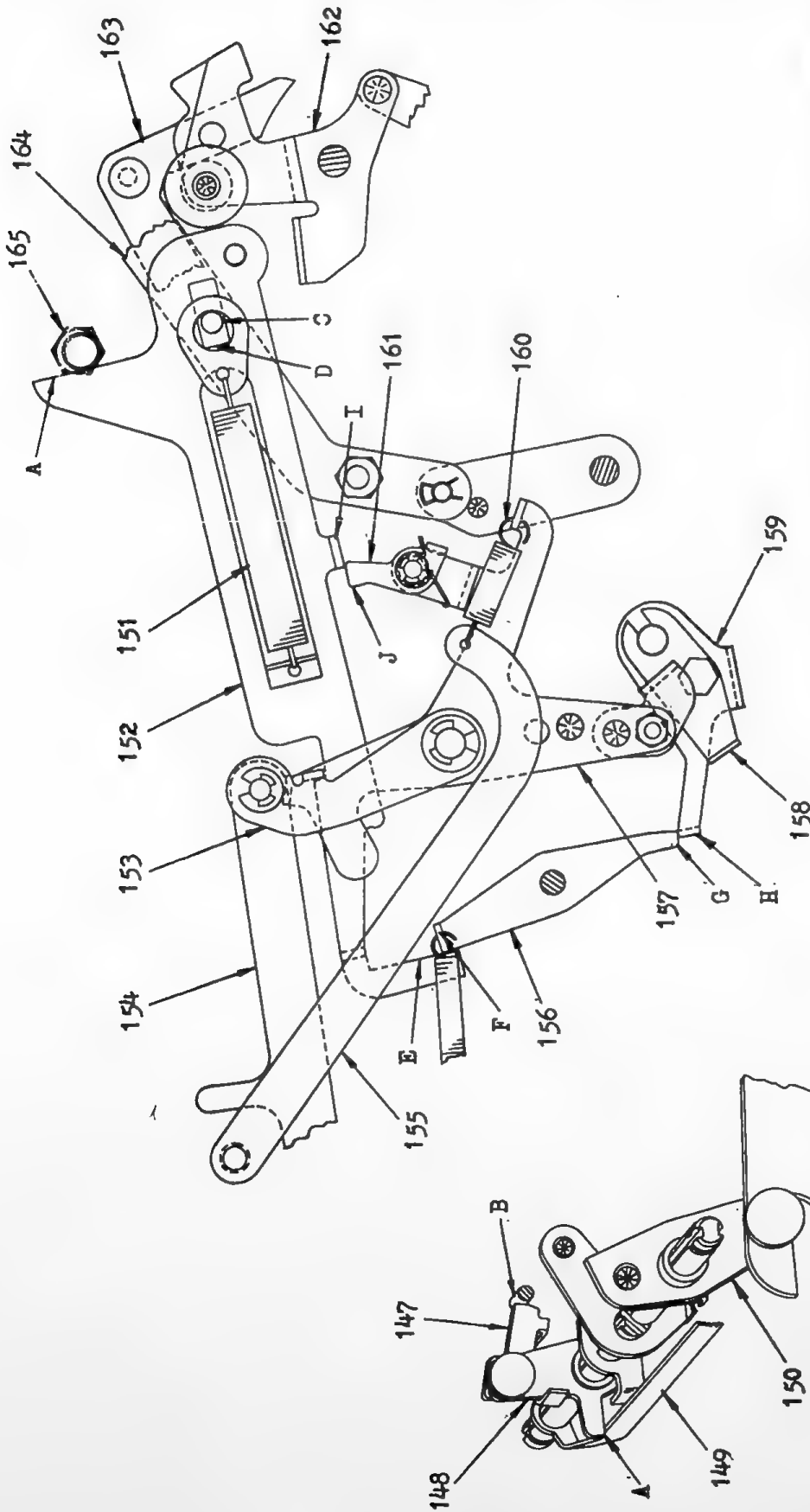


FIG. 13

- 142. Post Division Clear Link-Long-38070
- 143. Post Division Clear Bail-39110
- 144. Automatic Keyboard Clear Bail-39035A
- 145. Counter Control Sector-38010
- 146. Post Division Clear Lever-38085



157. Division Counter Control Shaft Ass.-38080
 158. Division Line-Up Shift Interlock Arm-38821
 159. Shift Interlock Rail-38837A
 160. Spring-7612
 161. Post Division Clear Live Tip-38068
 162. Switch Control Lever-38089A
 163. Product Clear Release Lever-39538* on 39537A
 164. Dip Sensing Link-38041
 165. Main Clutch Spring Stud Nut-38103

FIG. 15

151. Spring-7677
 152. Post Division Clear Link-Short-38125
 153. Post Division Clear Lever-38085
 154. Post Division Clear Link-Long-38070
 155. Spring Link-38051
 156. Post Division Interlock-38075A

FIG. 14

147. Clear Operating Arm Live Tip-39071* on 39065A
 148. Clear Operating Arm Assembly-39065A
 149. Post Division Clear Rail-39110
 150. Middle Dial Clear Rail-39086A

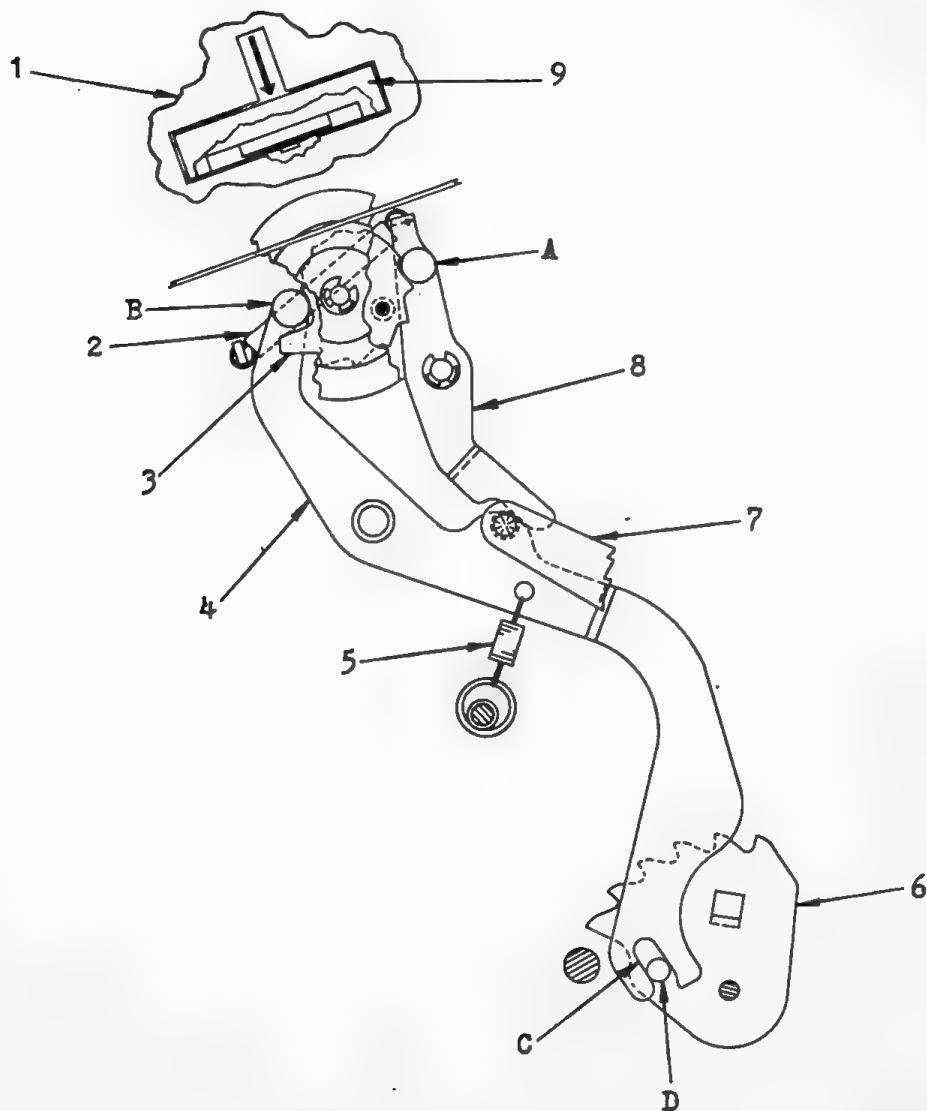


FIG. 16

1. Keyboard Cover-SK-94072
2. Spring-7277
3. Line-Up Selection and Cent. Cam-39654
4. Line-Up Selection Lever-39225A
5. Spring-7333
6. Line-Up Selection Count Out Segment- 39180A
7. Line-Up Disabling Interponent-39299
8. Line-Up Disabling Follower-39949A
9. Line-Up Control Knob-88488



DIVISION

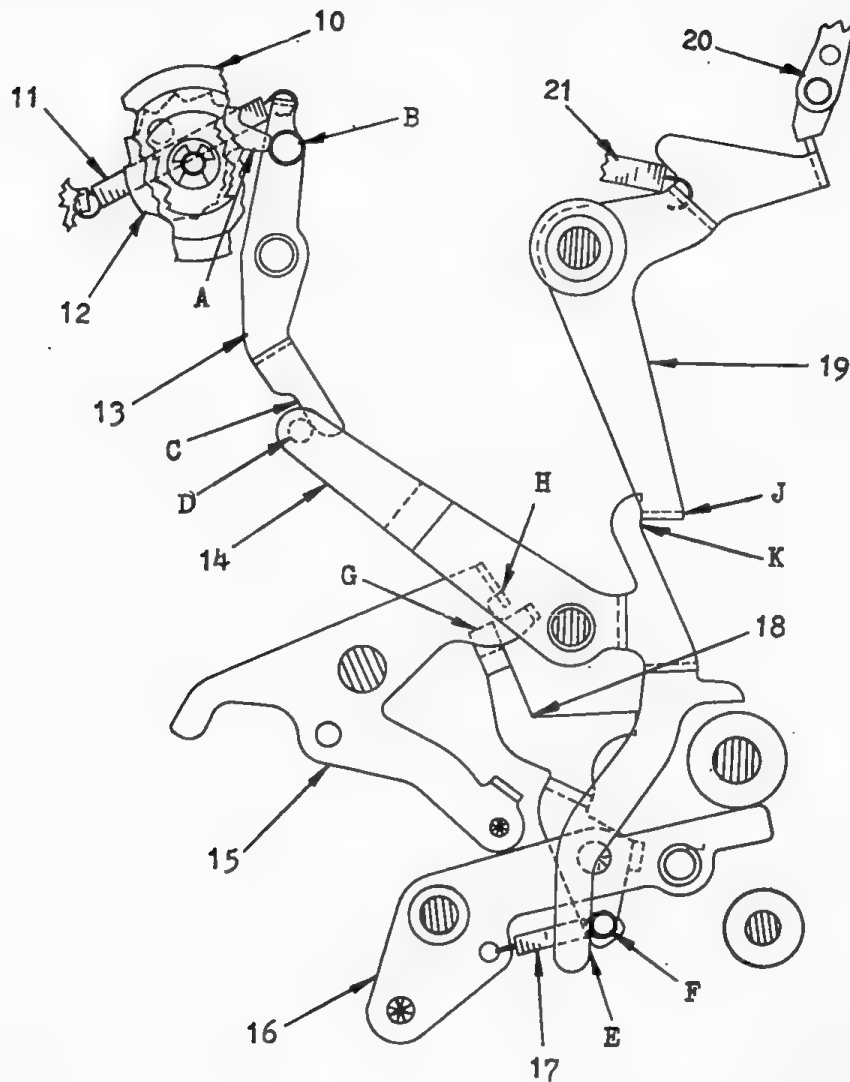


FIG. 17

- 10. Line-Up Control Knob-88488
- 11. Spring-7277
- 12. Line-Up Selection and Cent. Cam-39654
- 13. Line-Up Disabling Follower-39949A
- 14. Line-Up Disabling Interponent-39299
- 15. Division Line-Up, Stop, and Interlock Arm-38935* on 38080
- 16. Line-Up Shift Lever-38760* on 39215
- 17. Spring-7009
- 18. Division Pinning Blocking Lever-39205* on 39215
- 19. Line-Up Shift Disabling Lever-39640A
- 20. No. 10 Upper Carriage Brace-39635
- 21. Spring-7354

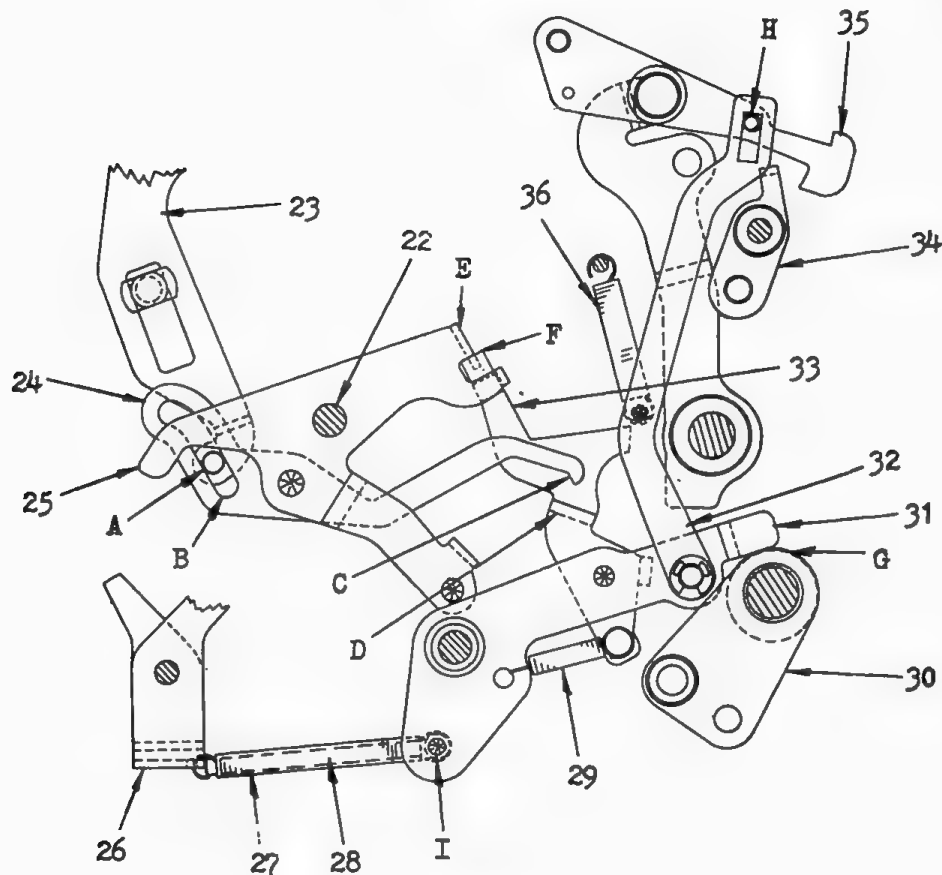


FIG. 18

- 22. Division Counter Control Assembly-38080
- 23. Line-Up Key-38990
- 24. Division Pinning Block Disabling Lever-36024
- 25. Division Line-Up, Stop and Interlock Arm-38935* on 38080
- 26. Continuous Setting Cycle Bail-38735A
- 27. Spring-7327
- 28. Drive Pin-38342
- 29. Spring-7009
- 30. Line-Up Drive Transfer Lever-39396
- 31. Line-Up Shift Lever-38760* on 39215
- 32. Line-Up Shift Link-39614
- 33. Division Pinning Blocking Lever-39205* on 39215
- 34. Right Shift Lever-38695C* on 38700
- 35. Shift Positioning Interponent-38960A* on 3950A
- 36. Spring-7276



DIVISION

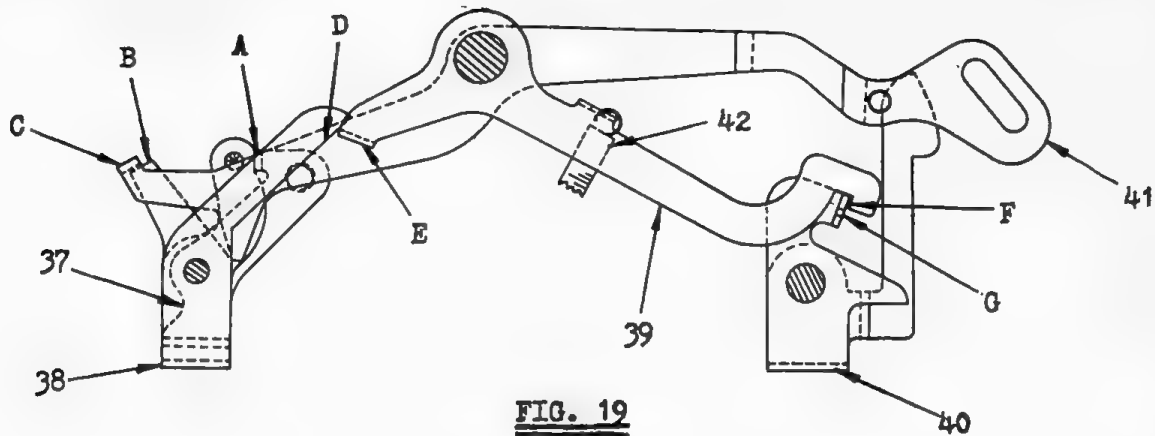


FIG. 19

37. Setting Clutch Opening Bail-38715

38. Continuous Setting Cycle Bail-38735A

39. Main Clutch Disabling Lever-38094

40. Main Clutch Disabling Lever-38736A

41. Starting Control Lever-38780B

42. Spring-7028

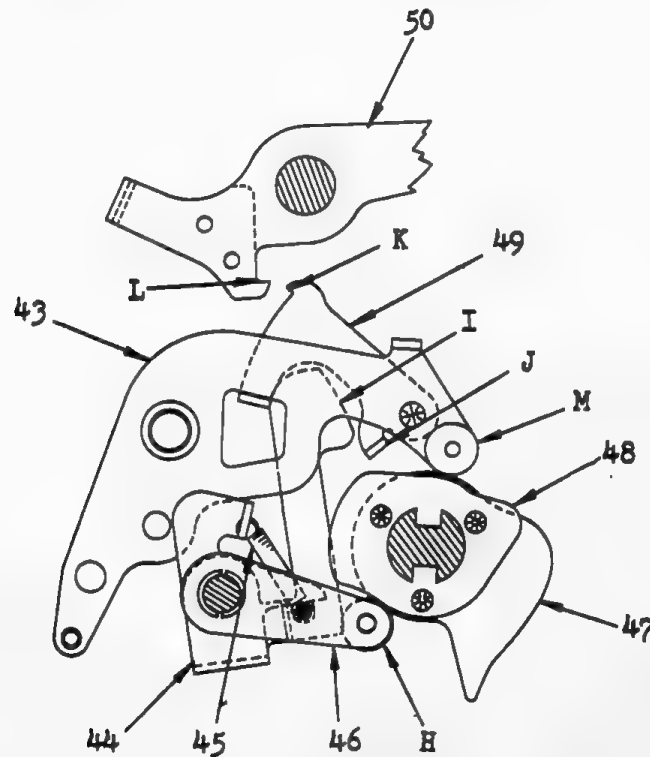


FIG. 20

43. Main Clutch Starting Arm-39905A

44. Main Clutch Disabling Lever-38736A

45. Spring-7032

46. Multiplier Trip Pawl Release Arm-36785A

47. Main Clutch Starting Cam-27086A* on 39985B

48. Multiplier Trip Pawl Release Cam-39936* on 39985B

49. Main Clutch Starting Lever-37603* on 39905A

50. Main Clutch Release Dog-36545C

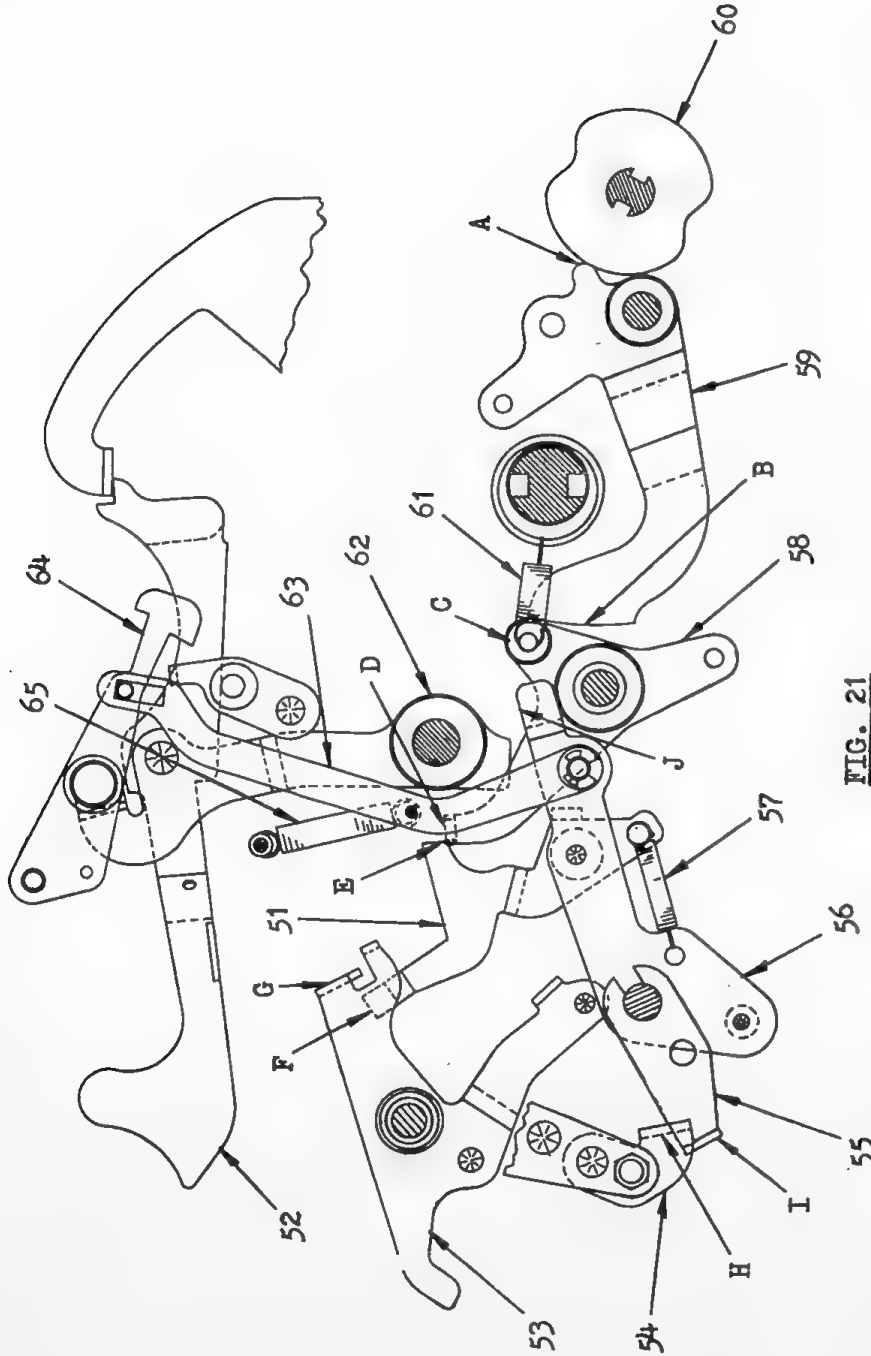


FIG. 21

- | | |
|--|---|
| 51. Division Pinning Blocking Lever-39205° on 39215 | 58. Block Disengaging Lever-39989A |
| 52. Division Line-Up, Stop and Interlock Arm-38935° on 38080 | 59. Restart Assembly-39295 |
| 53. Division Counter Reverse Arm-38175° on 38080 | 60. Restart Cam-38759 |
| 54. Division Counter Reverse Bar-36259 | 61. Spring-7681 |
| 55. Division Line-Up Shift Interlock Arm-38821 | 62. Reverse Setting Bar Link Spacer-38338 |
| 56. Line-Up Shift Lever-38760° on 39215 | 63. Line-Up Shift Link-39614 |
| 57. Spring-7009 | 64. Shift Positioning Interponent-38960A° on 38950A |
| | 65. Spring-7276 |

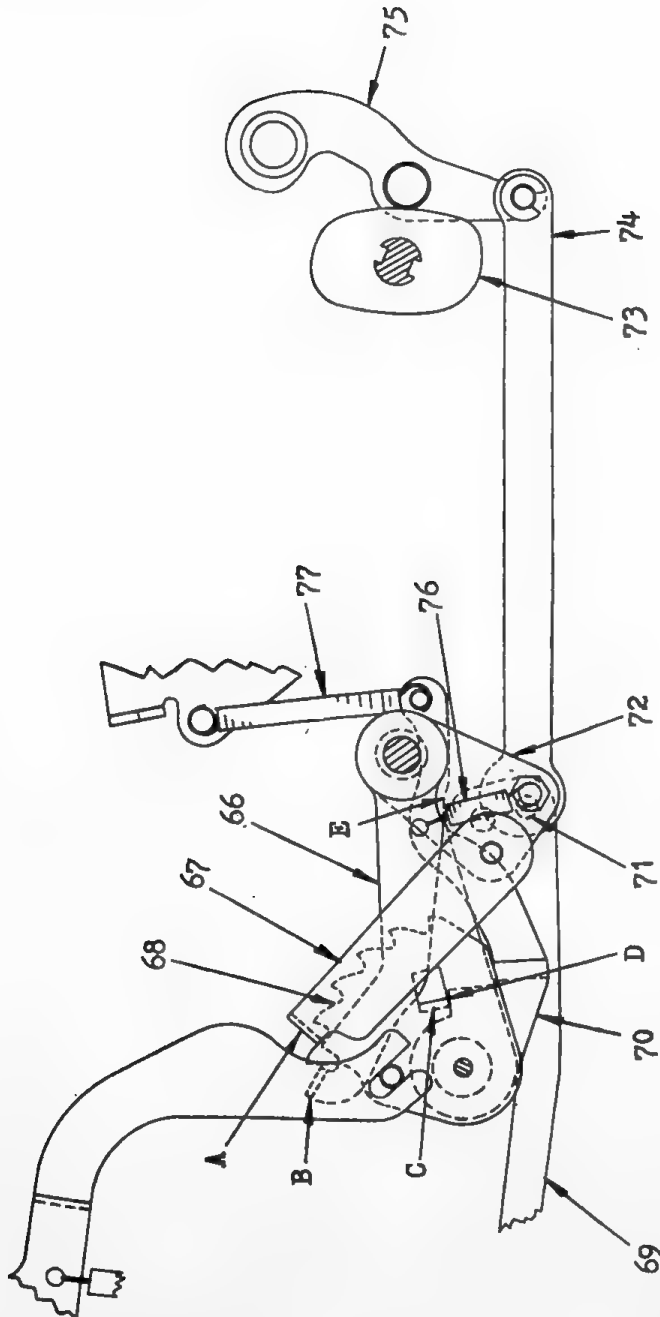


FIG. 22

- | | |
|--|--|
| 66. Idle-Up Holding Pawl-39237A | 72. Idle-Up Drive Transfer Lever-39396 |
| 67. Idle-Up Driving Pawl-39233 | 73. Idle-Up Driving Cam-38762 |
| 68. Idle-Up Selection Count Out Segment-39180A | 74. Idle-Up Driving Link-38761 |
| 69. Shift Latch Lever-38775 | 75. Idle-Up Driving Cam Follower-39050 |
| 70. Idle-Up Shift Disabling Lever-39643 | 76. Spring-7017 |
| 71. Shift Latch Eccentric Stud-38784 | 77. Spring-7682 |

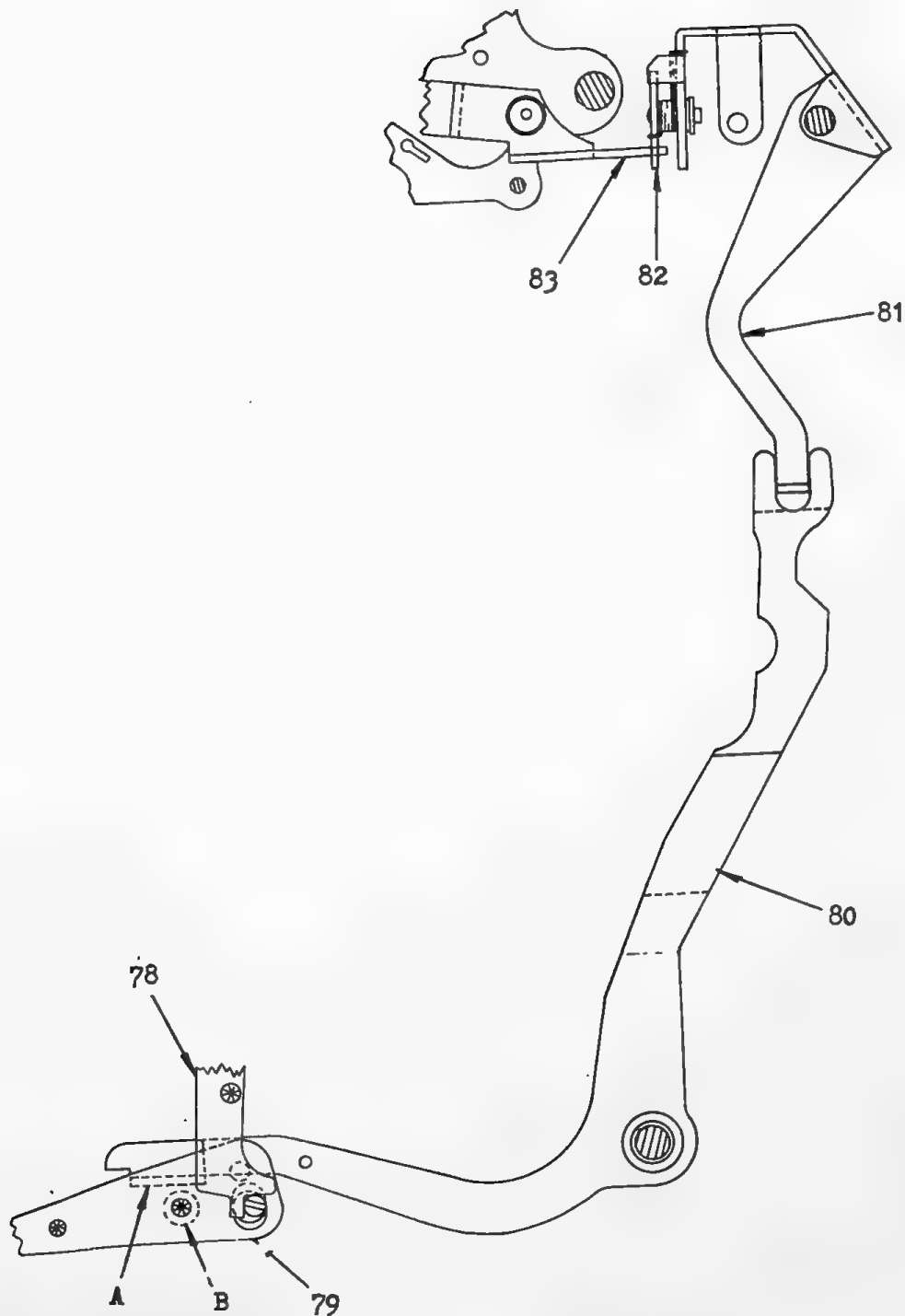


FIG. 23

78. Shift Latch Control-38785B

79. Shift Latch Lever-38775

80. Shift Terminating Ball Crank-39685

81. Shift Terminating Trip Lever-72458

82. Selective Carriage Positioning Live Tip-72525

83. Shift Terminating Finger-39626A* on 39630A

MERCHANT*



DECI•MAGIC*

(MODEL SKA)

ADJUSTMENT PROCEDURE BOOK

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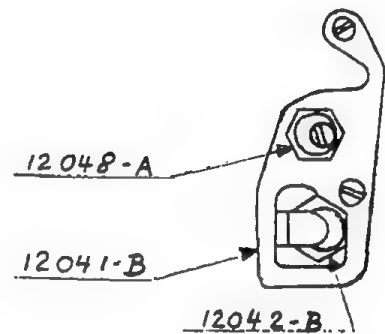
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SKA ADJUSTMENT PROCEDURE

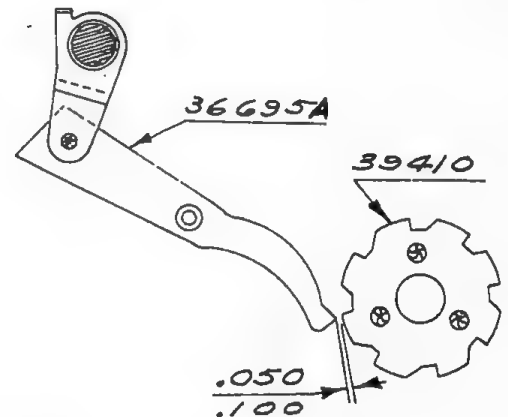
-FIELD EDITION-

In order to perform a complete adjustment of a Deci-Magic Calculator, the machine must be in the following condition: Carriage, Top Plate and Key Sections must be removed, #5 Tab Key must be depressed with the Traveller in the corresponding order, the Drive Idler on the left side must be disengaged and the Slip Clutch must be as wide open as possible.

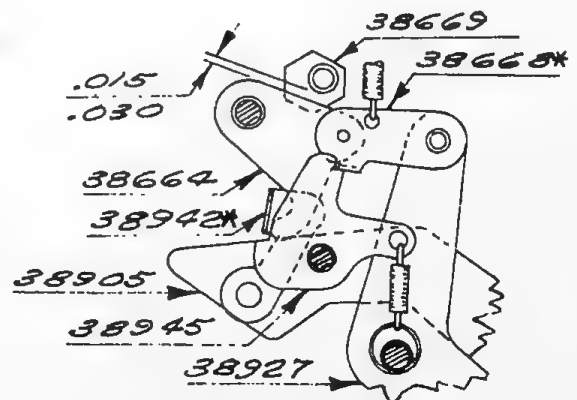
1. RESTORE SHAFT BEARING must be tight in 12041-B Retainer.(Eccentric). See sketch.



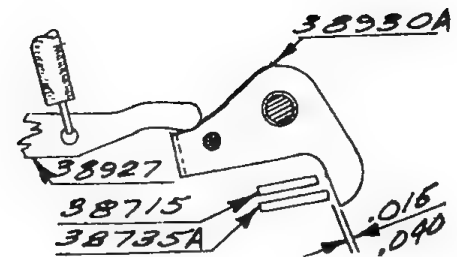
2. MASTER CLUTCH INTERLOCK: Depress Clear Release Dog Lever-38033-A and crank until M.C. Dog rests on clutch housing; rock Setting Cycle Bails 38715, 38735A; clearance between Starting Arm 36695A and Ratchet on Idler Assembly 39410 must be as indicated with play removed. See sketch. (Adjust through 38090).



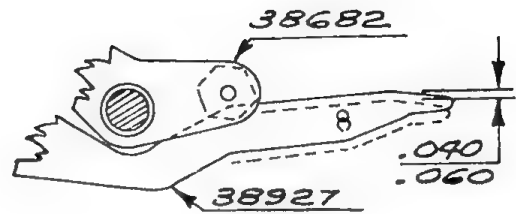
3. TAB TOGGLE LATCH: Clearance between 38664 and Eccentric 38669 must be as indicated (in latched position). (Turn Eccentric). See sketch.



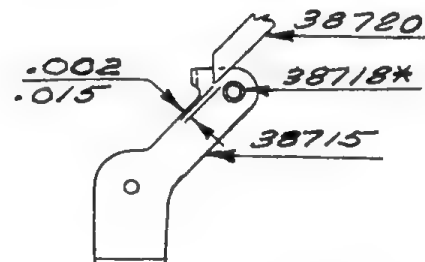
4. SHIFT STARTING BELL CRANK must have clearance to Setting Cycle Bails as indicated. (Bend 38927 Arm). Check lateral engagement of 38927. See sketch.



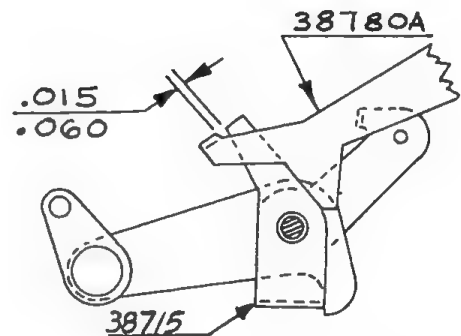
5. SHIFT ASSIST LEVER must be overstroked during Setting Cycle as indicated. (Eccentric 38682). See sketch.



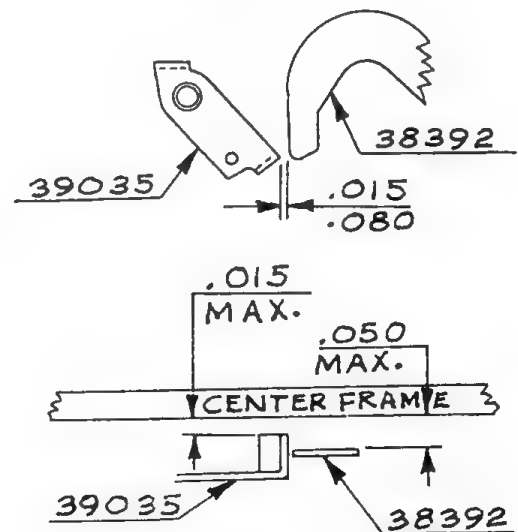
6. RESTART LEVER 38720 must have clearance to stud on Setting Cycle Bail as indicated. (Bend Arm of 38720). See sketch.



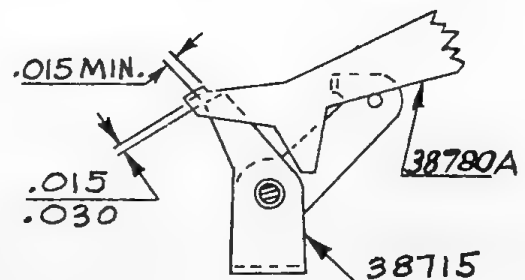
7. STARTING LEVER RELEASE off Add Key: Depress Add Bell Crank; lift Starting Lever to check indicated clearance. (Eccentric). See sketch.



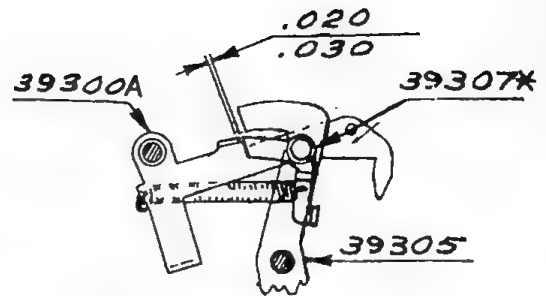
8. KB CLEAR LINK: With Add Bell Crank depressed KB Clear Link-38392 must have clearance to 39035 Bail as indicated. (Bend 39035 if necessary. Check Add Hatchet Spring). Check lateral clearances. (Form 38392). See sketches.



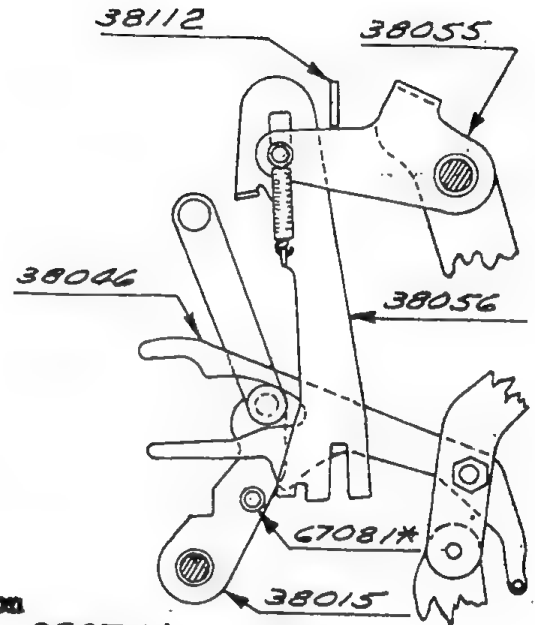
9. STARTING LEVER RESTORE: Starting Lever must overstroke Setting Cycle Bail as indicated. See sketch.



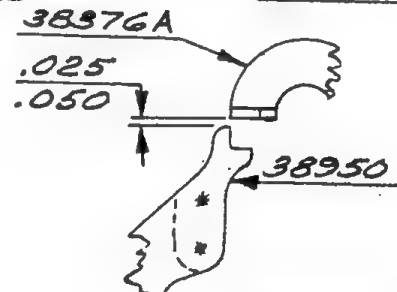
10. ADD HATCHET RESTORE: With Add Bell Crank and Live Point on Add Hatchet held depressed, Live Point must overstroke ear on Bell Crank as shown. (Eccentric). See sketch.



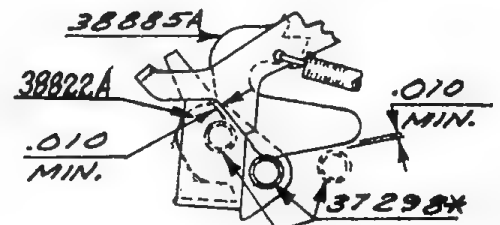
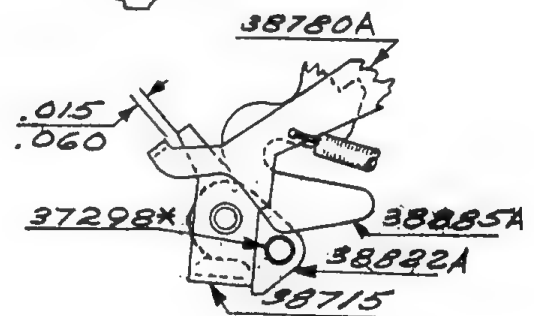
11. COUNTER RETURN LEVER: Knob on "+" or "-", crank through subtract cycle: Nose on 38046 must not move stud on 38015. (Bend 38055). Check engagement of stud on 38015 with ear on 38056 in X-NE position. See sketch.



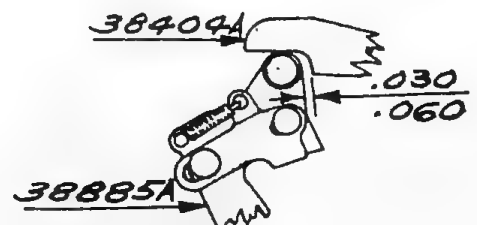
12. SHIFT DISABLING on first carriage rise in division must be as shown. (Bend 39946 Interponent). See sketch.



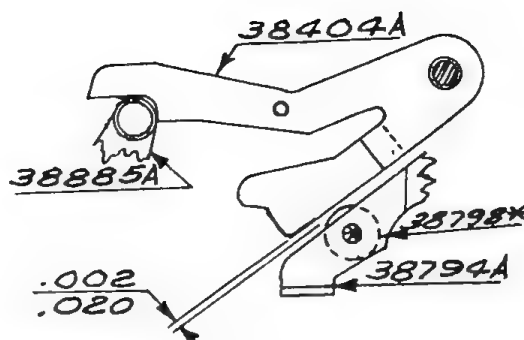
13. SETTING CYCLE INITIATION ON DIVISION (on restore of Hatchet) must be as indicated. (Bend lower arm of Hatchet). Check clearance to stud 37298* on 38822A in latched and through positions of Hatchet. See sketches.



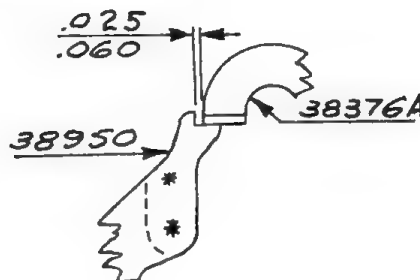
14. DIVISION HATCHET OVERSTROKE to 38404A must be as shown. (Standard Eccentric). See sketch.



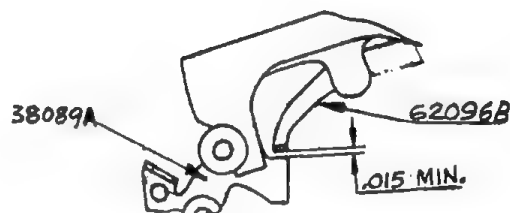
15. RESTART BELL CRANK Stud must have clearance to 38404A Latch as shown after Division Hatchet has settled back on the Latch. (Bend Restart Bell Crank). See sketch.



16. AUTOMATIC SHIFT LEVER must be overstroked by ear on 38376A as shown. (Bend lower ear of 38376A). Check lateral alignment. See sketch.



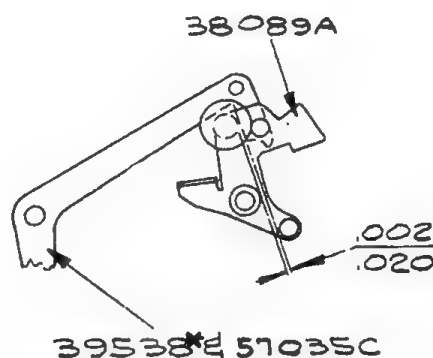
17. STARTING SWITCH INTERLOCK; Clearance between Switch Interlock and 62096-B in dip must be as shown. (Bend 62096-B). See sketch.



18. IDLER GEAR ECCENTRIC must be adjusted for minimum gear noise.

19. SETTING LINE CENTRALIZER must be adjusted as standard.

20. SHIFT CLEAR INTERLOCK; With both Clear Levers 39538* and 57035C depressed, clearance to roller on 38089-A Switch Interlock must be as shown. See sketch. (Eccentric).

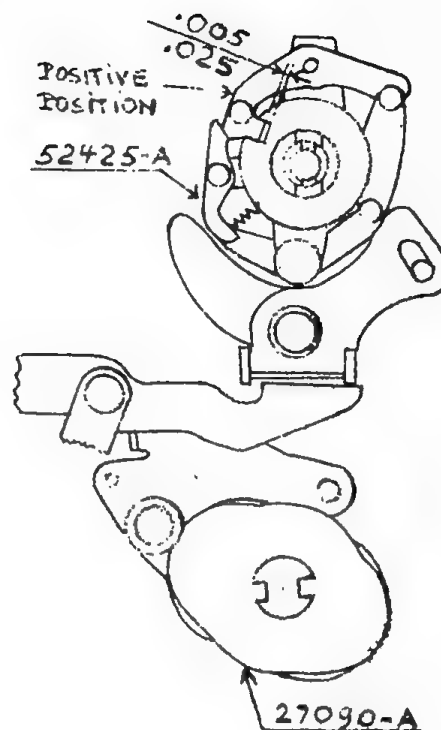


21. SWITCH POINTS; .015 minimum clearance at rest position; closed when Setting Starting Bails are rocked and Starting Arm is on high of Ratchet. (Standard).

22. SHIFT JACK SHAFT must be centralized.

23. REVERSE CLUTCH must centralize freely.

Crank through Add and Subtract Cycles and check for free play of dog when cam 27090-A is on high point. See sketch.



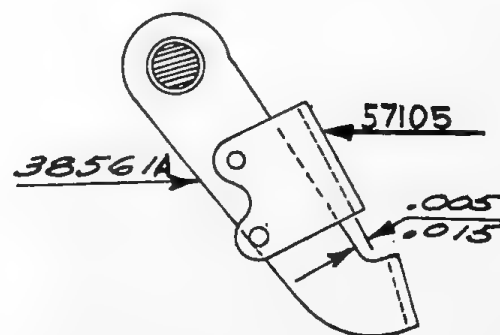
24. HALF TURN CENTRALIZER must be adjusted so that Arms move out of notch simultaneously. (Move Pivot Screw).

25. UNLATCHING ARM of Half Turn Centralizer must be adjusted short of snapping noise. (Bending).

26. PIVOT GEAR PAWL RELEASE ARM must be snug but not tight. (Eccentric).

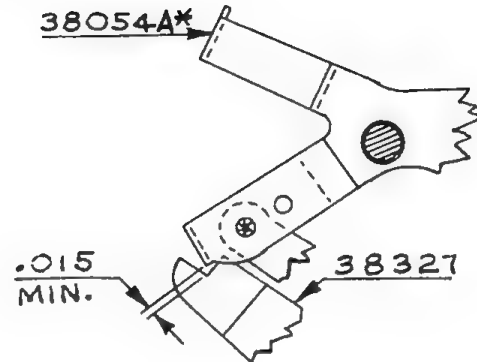
27. CLEAR OPERATIONS: Entire linkage must be perfectly free. Only one cycle must occur when UD Clear Key is held partially depressed; multiple cycles on MD Clear Key. (Eccentrics).

28. MASTER CLUTCH BAIL 38561-A must have .005 - .015 clearance to 57105 as shown. (Bend). See sketch. End Play .005 - .020 (Screws).

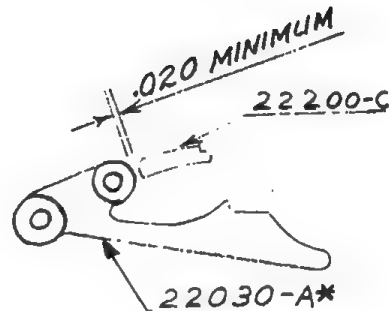


29. COUNTER ECCENTRIC CONNECTING LINK 67156 must centralize freely and must have no more than .015 end play.

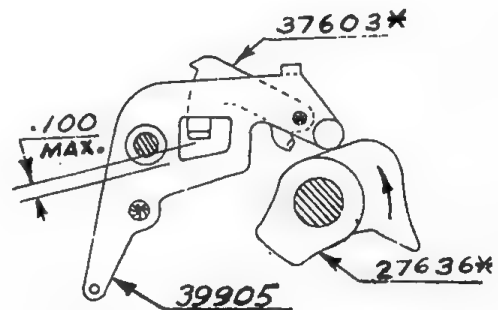
30. DIVISION KEY LATCH must have .015 minimum overstroke. To check, hold Division Hatchet back and let go through slowly. See sketch.



31. DIVISION GATE TRIP: Trip all Sensing Levers except rightmost one; adjust for .025 minimum clearance between 22245* Arm and ear on 37460A*. (Eccentric). Check that Roller Latch is released upon depression of last Sensing Lever.



32. DIVISION GATE STOP: With all Sensing Levers released, check for clearance to last Sensing Lever as shown. (Adjust Stop). Check position of Live Point 37603*. Repeat preceding adjustment to meet all specifications. See sketches.



33. DIVISION STOP & RESTORE: Depress Stop Key twice, when cycling continuously, first slowly, then rapidly. Check for correct action.

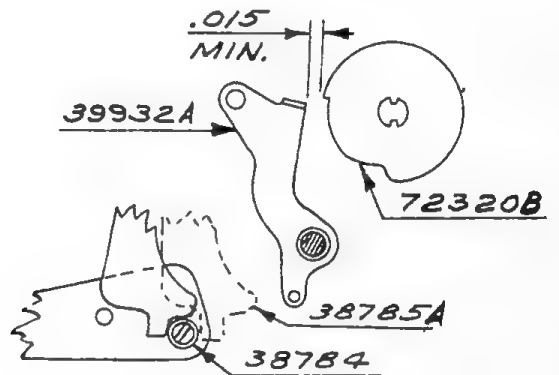
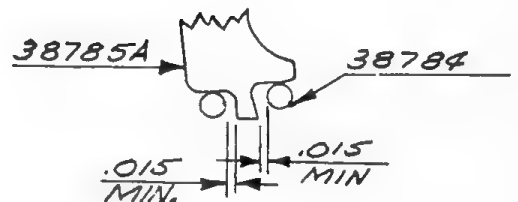
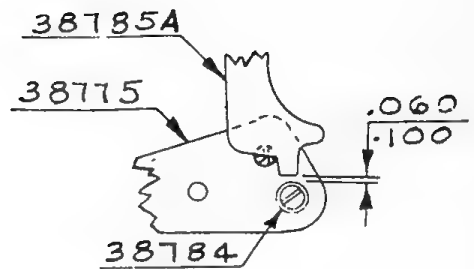
34. LAST POSITION STOP LEVER: Check freeness and lateral alignment of 38880A.

35. SETTING CYCLE INITIATION - FD CLEAR:

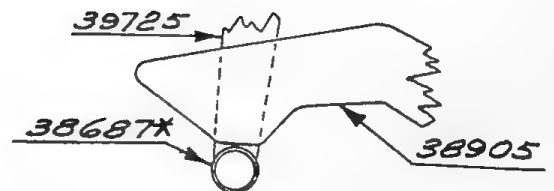
Check clearance shown after depression of FD Clear Key. (Bend ear on 38590).

SEE SKETCH WITH PARAGRAPH 7
ON PAGE 2.

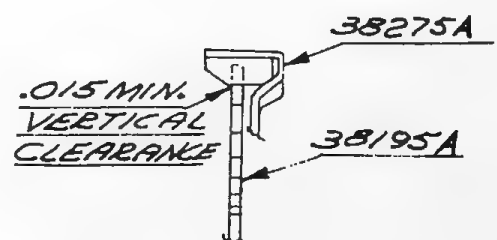
36. SHIFT LATCH: Clearance between 38785A and stud on 38775 Shift Latch must be as shown at rest. (Bend 38775). In both shift directions clearances to 38785A and on Shift Clutch must be as shown. (Adjust 38784 Stud). Shift Latch must be seated on 38785A during shift. See sketches.



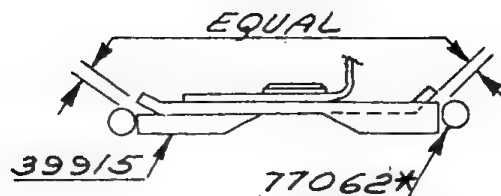
37. TAB KEY SECTION: Adjust Tab Key Section with Holding Screws (bottom) and Set Screws (Front Frame) so that Roller 38687* comes to rest on flat of 38905 in every order without straining or overshifting. Keys must be easy to depress (less than 38 oz.), and must not stick down upon double depression. See sketch.



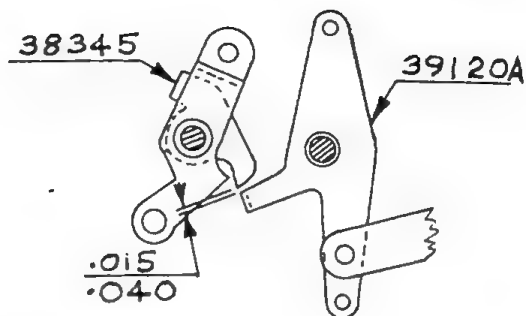
38. MULTIPLIER TRAVELER must be timed so that 38275A is centered on 38195A in every order. Check vertical clearance. Check that gear train centralizes in every order. With #0 Tab Key depressed, check that 38680 Master Clear Link is free. See sketch. -7-



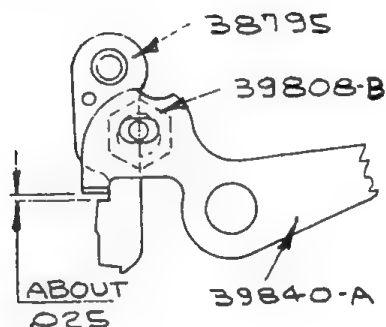
39. TAB TRAVELLER must be centralized in every order, having equal clearance to Ball Studs on either side. **See sketch.**



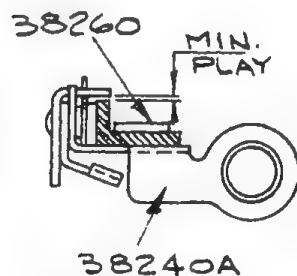
40. FD CLEAR - LATCHING. Check overstroke of ear on 39120A. (Eccentric). **See sketch.**



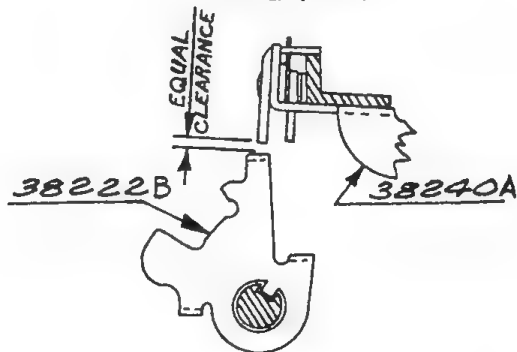
41. **ECCENTRIC 39808B - PRESETTING:** Depress FD Clear Key, crank to second high point of Restore Cam. Check overstroke of 39840-A to 38795 Latch. (Adjust 39808B, notch up). **See sketch. (See also Page 11A)**



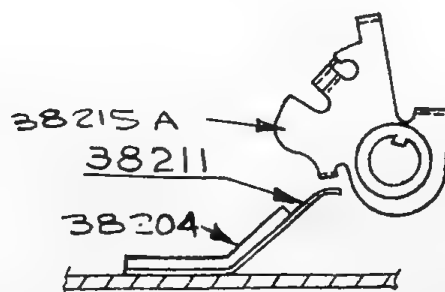
42. TRAVELLER, VERTICAL PLAY (38240-A). Remove excess play by bending guide ear. **See sketch.**



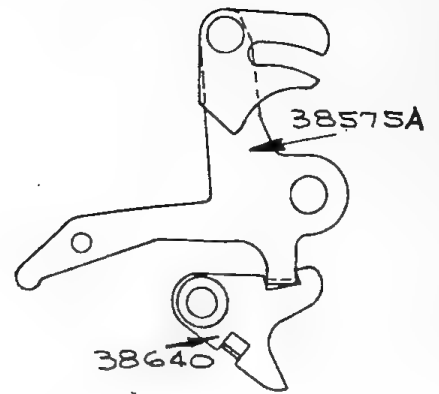
43. STRAIGHTNESS OF SHIFT CONTROL BAIL. Vertical clearance between 38240-A and "Ordinals" must be equal in both end orders. (Twist 38260 Bail). **See sketch.**



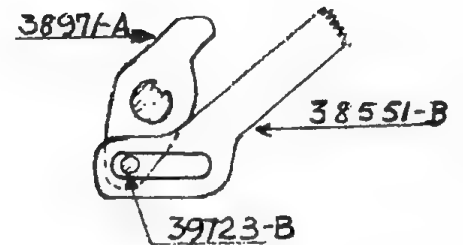
44. LEAF SPRING must contact upstop 38204 - All ears. **See sketch.**



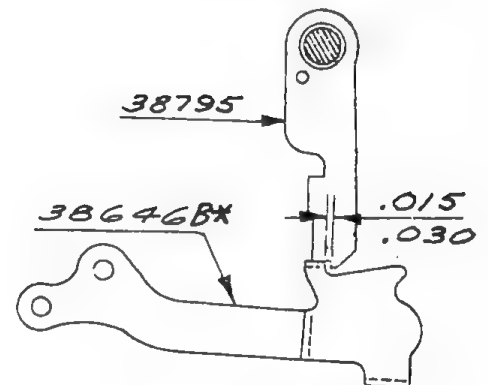
45. POSITIONING LEVER LATCHING: Depress "X-Key" (Starting Levers), make set-up and crank until 39740A is released. Check that it goes all the way forward. Check that 38640 Latch engages ear on 38575B fully. (Bend ear). Check freeness of 38445C "Pusher". See sketch.



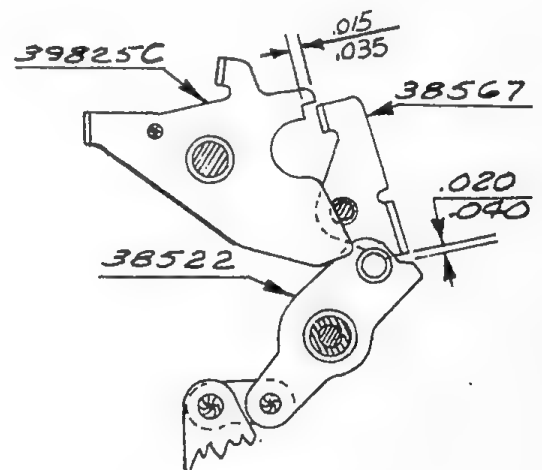
46. "ORDINAL SHAFT" ECCENTRIC: Preset 39723B Eccentric to about 3/4 from high point. See sketch.



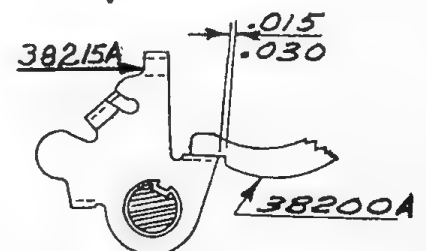
47. "PUSHER" CLEARANCE to Latch 38795 must be as shown when 38575B is latched. (Exchange Roller on cam; move pivot Bracket of 38646B*). See sketch.



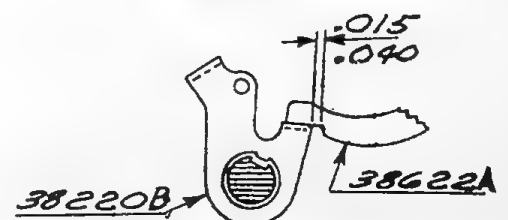
48. SELECTION RESTORE LEVER must overstroke 38567 as shown (Eccentric on Follower). Clearance between 38567 and 39825C must be as shown when 38567 is moved manually. (Bend ear on 38567). See sketch.



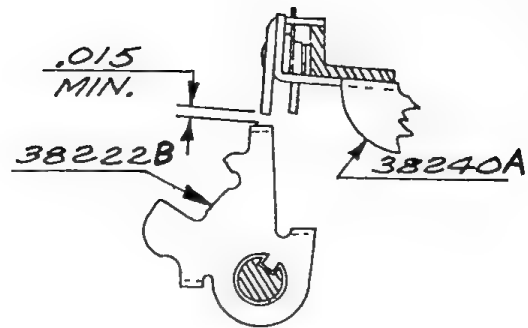
49. "ORDINALS" OVERSTROKE: Crank until Bail 38260 drops. Check for some free movement in Outer Master Clutch Power Bail. Adjust Eccentric on Power Bail (rear of machine) to get this play.



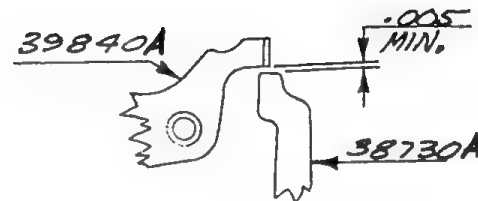
"Ordinals" overstroke must be shown in all orders. (Equalize by bending rear ears on "Ordinals"). Adjust front Eccentric on "Ordinal" Shaft to obtain overstroke. See sketches.



50. SHIFT CONTROL BAIL LIFT: After Traveller has moved to leftmost order, initiate Setting Cycle. Bail 38260 must lift Traveller above "Ordinal" as shown. See sketch.

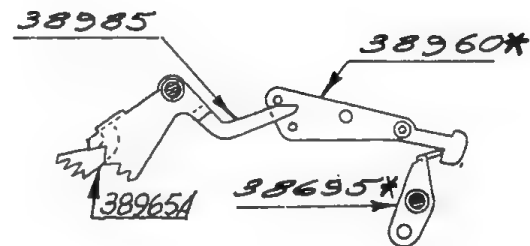


51. MULTIPLICATION RESTART: When Traveller starts shifting to next order, move Restart Lever 38670 rearward and check that 38730-A Interponent moves under ear on 39840-A Arm. Check in several Orders. (Adjust 39808-B Eccentric). See sketch.



NOTE: The following 5 adjustments are affected by setting of 39808-B. Also see page 11A.

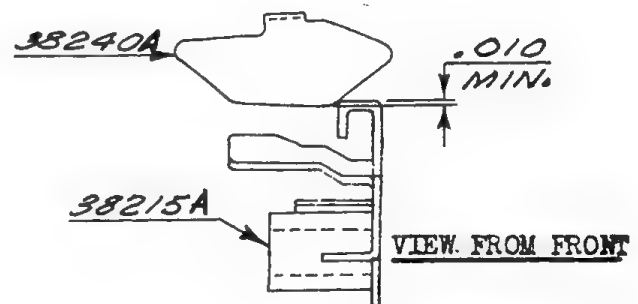
52. RIGHT SHIFT INDICATION: Set-up digit to left of Decimal position. 38960* must bottom on 38695* when 38260 Bail drops. (Bend 38965-A ear). See sketch.



SEE FIGURE 36

53. SHIFT LATCH - BOTTOMING: 38775 Shift Latch must be bottomed on 38785-A during shift.

54. MULTIPLICATION RESTART: As Traveller cams up to a position .010 below its highest point on 38215-A, the Starting Arm must be released from Setting Starting Bail. Check in several Orders.



See sketch.

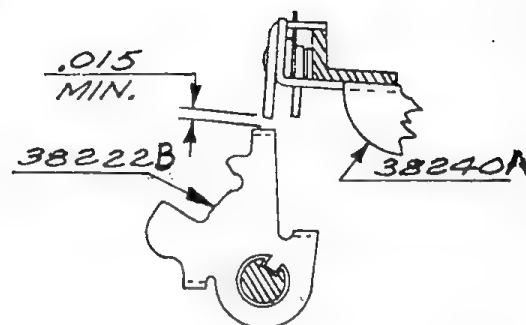
55. NON-SHIFT INDICATION: With set-up in home order, 38576-A Interponent must block firmly on ear on 39840-A.

SEE PAGE 1265 OF "DECI-MAGIC"
SERVICE INSTRUCTION BOOK.

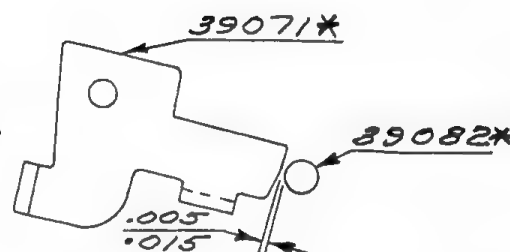
56. LEFT SHIFT INDICATION: With set-up to the right of the home order, ear on 39840-A must neither move high enough to move ~~38960*~~, nor must it block 38576-A.

SEE PAGE 1265 OF "DECI-MAGIC"
SERVICE INSTRUCTION BOOK.

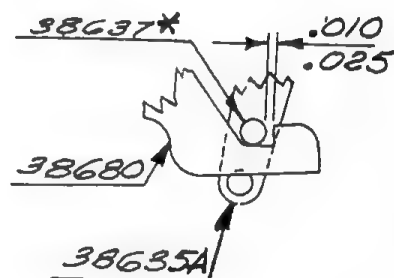
57. CLEARANCE TRAVELLER TO "ORDINALS" must be .015 minimum in rest position. See sketch.



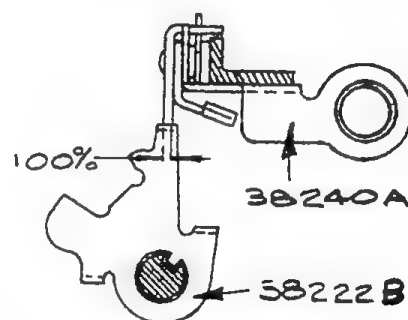
58. CLEAR LIVE POINTS 39071* must freely rock in front of Studs 39082* on Clear Bails with clearance as shown. (Set screw on Front Frame). See sketch.



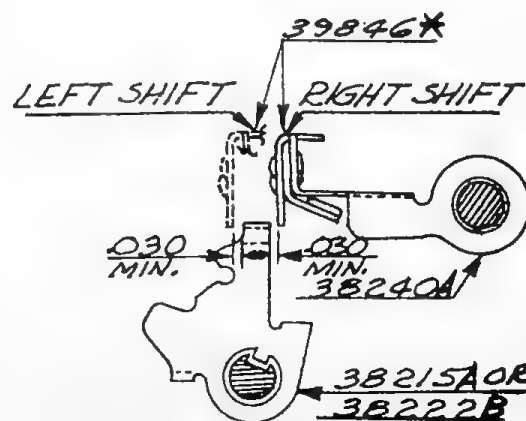
59. MASTER CLEAR LINK CLEARANCE to stud on 38635-A must be as shown with multiplier set-up in left order. (Eccentric on 38680). See sketch.

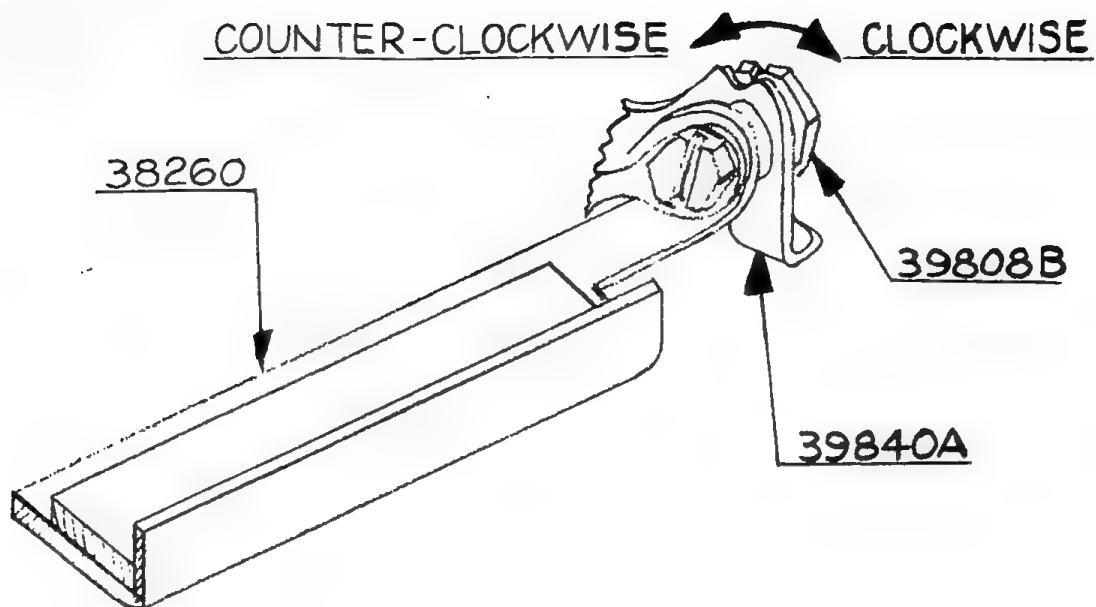


60. TRAVELLER ENGAGEMENT WITH "ORDINALS": #0 Tab depressed, make set-up in 1st order. Check 100% engagement of Traveller with "Ordinal". Repeat in all orders. (Bend ears on 38215-A "Ordinals"). See sketch.



61. TRAVELLER CLEARANCE DURING SHIFT must be as indicated with set-ups in 1st and 10th orders. See sketch.





ADJUSTMENT OF 39808B ECCENTRIC

Adjustment of the 39808B Eccentric affects all of the following checks. However, the first two items are the most critical ones and the eccentric should be set primarily to satisfy them. Only if on any machine the first two items show a wide safety margin should the eccentric be re-set slightly to satisfy any of the other requirements:

Affect on Adjustment
if Rotated Counter-
Clockwise

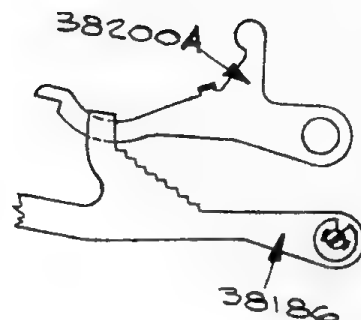
Adjustment

Affect on Adjustment
if Rotated Clockwise

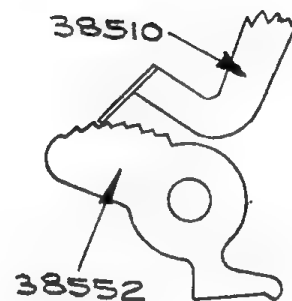
Less Safety	Conditioning for Restart	Safer
Safer	Restart (Starting Arm Release)	Less Safety
Less Safety	Right Shift Indication	Safer
Less Safety	Shift Latch - Bottoming	Safer
Safer	Mult. Shift Termination	Less Safety
Lowers ear	Non-shift Indication	Raises ear
Lowers ear (danger of non-shift)	Left Shift Indication	Raises ear (danger of right shift)
Less Clearance	Shift Control Traveller - clearance	More clearance

62. MULTIPLIER CHECK DIALS must be free both at rest position and under tension of their Torsion Springs (X-Key depressed, 38510's moved).

63. BLOCKING LEVERS 38200A must have at least .015 lateral clearance to zero-steps on 38186 Links. (Bend if necessary). See sketch.

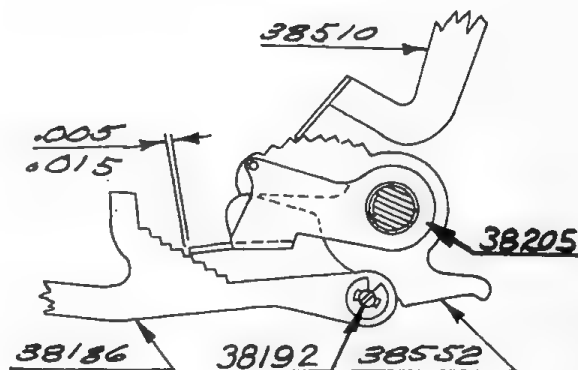


64. MULTIPLIER SELECTION LEVERS 38510 must line up with 38552 Step Cams. (Bend if necessary). See sketch.



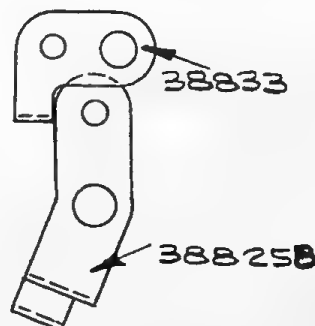
65. FRONT DIAL ALIGNMENT: Align all zeros (bending); align "5"'s (Eccentrics); align Decimal "Flags" (bending).

66. SELECTION STORAGE: Depress "X-Key", set up all 8's, crank until 38205's drop. Adjust for clearance as shown between 38205's and 38186's. (Eccentric 38192). See sketch.

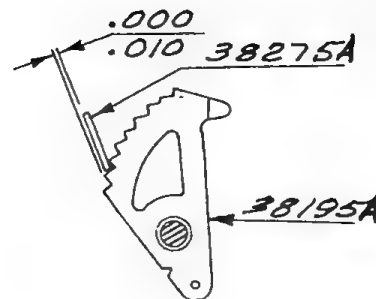


67. MULTIPLIER SELECTION: Depress "X-Key", set up "7" in 5th order; check transfer to Trip Unit: Pawl must drop into tooth space on Gear without moving it. Repeat with "5" and "9". (Eccentric).

68. #9 SELECTION STOP: With #9 locked in Trip Unit, move #9 Stop 38833 to just touch Transfer Bail 38825B. See sketch.

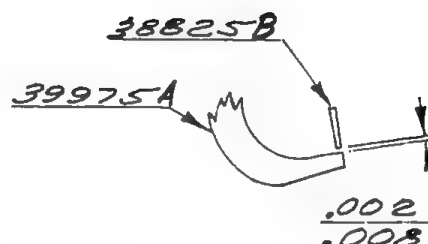


69. COUNT-OUT ARM must have clearance as indicated when it rests on #8 Step of 38195A Step Cam. (Bend). See sketch.



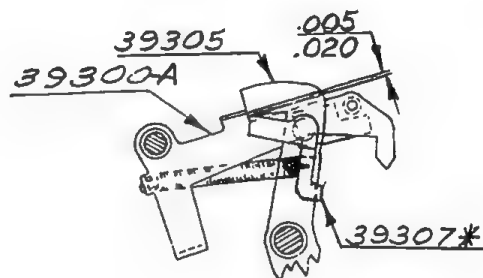
70. SELECTION LOCKS: Make #1 set-up in 10th order and slowly pull Links 38186 forward: All 38205 Locks must drop freely from step to step.

71. TRANSFER BAIL: Clearance between ear on Transfer Bail and tip of 39975-A Block must be as shown. (Bend 39975-A). See sketch.

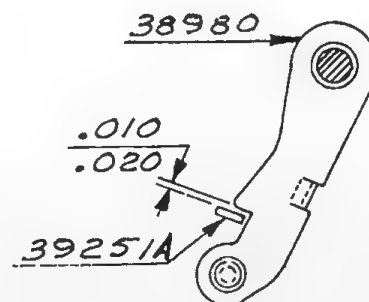


72. FD CLEAR DISABLING: Check Lever 39700-B for freeness.

73. ADD BELLCRANK: In rest position clearance between ear on Add Bellcrank and tip of Live Point of 39305 must be as shown. (Bend Bellcrank ear). See sketch.

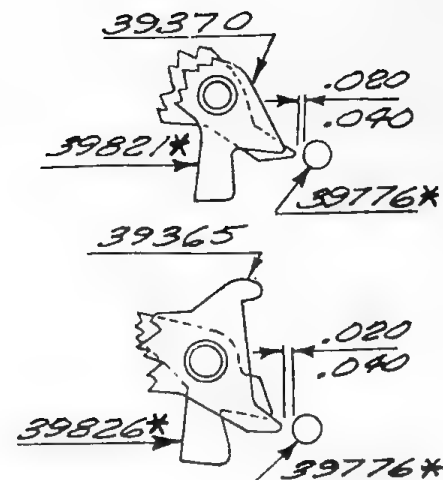


74. FRONT DIAL LOCK: Check overstroke in Top Plate as shown (bend ear on 39251A). See sketch.



75. INSTALL TOP PLATE. Watch for Restart Lever.

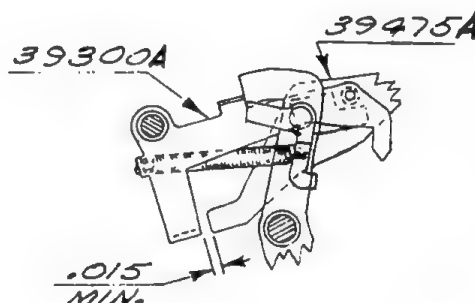
76. X=BAIL CLEARANCES to stud on 38635A
Lever must be as shown. (Eccentric on
Outer M.C. Bail). After adjustment re-
check to Para. #49.



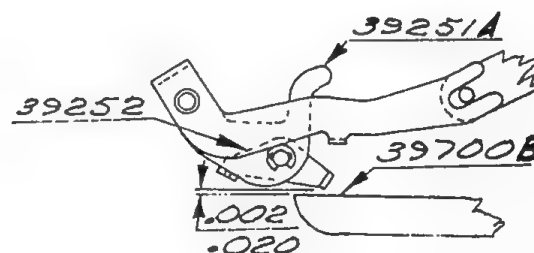
77. X-BAIL LIVE POINT must rock both ears
on Starting Levers 39825C and 38610B, must
become disengaged and return to normal
above ears.

SEE FIGURES 25 & 27 ON PAGES 1249 & 1251
OF "DECI-MAGIC" SERVICE INSTRUCTION BOOK.

78. DIVIDEND KEY: After depression clear-
ance between 39475A and 39300A must be as
shown. Check for Dividend Hatchet over-
stroke. (Eccentric). See sketch.



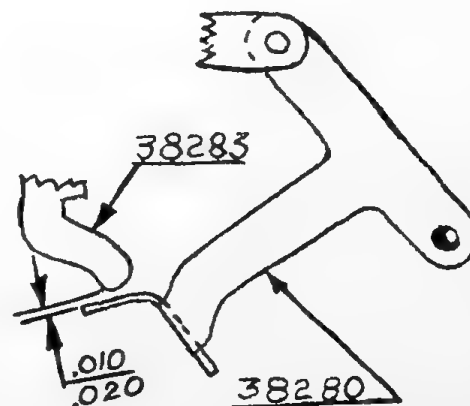
79. FRONT DIAL LOCK: FD Lock Key depressed,
move 39700-B. Clearance must be as shown.
(Bend 39700-B; check freeness), See sketch.



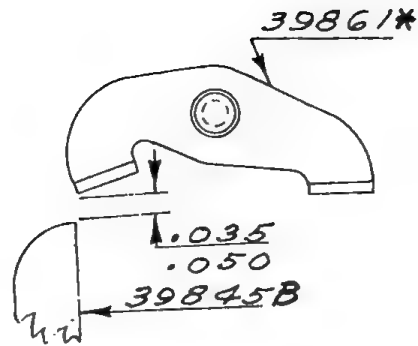
80. INSTALL KB CLEAR BAIL, adjust for
.002-.010 end play.

81. CHECK KB CLEAR BAIL for clearance to
Keysections as shown; (adjust with stop ear
on Front Frame Bracket).

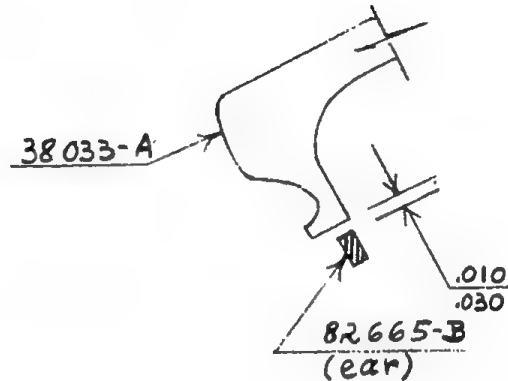
Check Add, KB Clear, Lock, Unlock Keys.
See sketch.



82. SQUARING: Square Key depressed: Live Point on KB Clear Bail must clear tip of KB Clear Lever as shown. Check lateral alignment. See sketch.



83. CLEAR RELEASE DOG LEVER 38033-A; Check clearance at rest as shown. Align. See sketch.



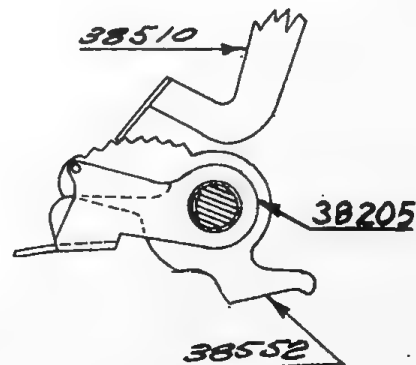
84. FUNCTIONAL CHECK of all Control Keys.

85. INSTALL AND ADJUST KEY SECTIONS.

86. SELECTION SETTING LINKS: With #8 Setup in Actuator check .005-.025 free play of Feeler Fingers on all orders. (3 Eccentrics).

87. ACTUATOR: Firmness of pawls on "0" set-up in dip; pawl backlash even for all setups; gear alignment with 3's, all 7's.

88. SELECTION LEVERS 38510: Power off, set up all 8's in KB, depress X-Key; depress #1 Keys. KB Check Dials must move down slightly but entire figures "8" must still be visible above lower edge of window. (Adjust by entering 9's and bending 38510 ear up where Dial did not move, down where it moved too far). See sketch.

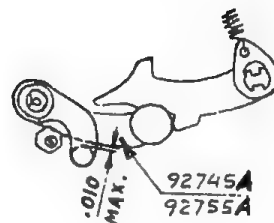


89. FRONT DIAL SELECTION: Check all setups, always holding some of the Keys down and forward during X-Key depression.

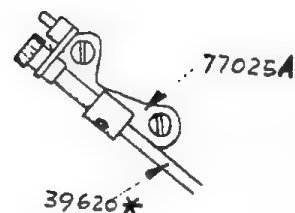
90. KEYBOARD: Check all Control Keys for KB Clearance, proper function.

91. ASSEMBLE CARRIAGE.

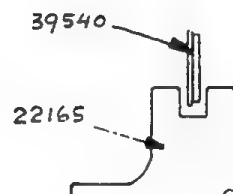
92. SPLIT CLEARANCE: Knobs must slide freely, clearance to Eccentric must be as shown. See sketch.



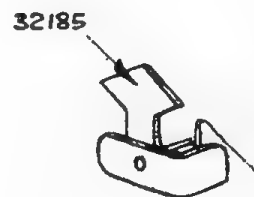
93. CARRIAGE DRIVE SYSTEM: Shaft 39620* freely movable, minimum end play. Engagement of Rack and Pinion as deep as possible; .005 maximum play on Bevel Gear. See sketch.



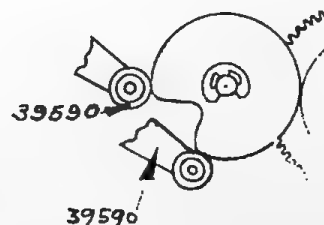
94. DIVISION SHIFT LOCK: Check Carriage position. See sketch.



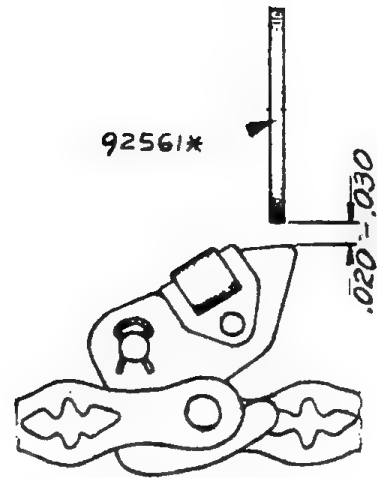
95. CARRIAGE SHIFT LOCK: Carriage must not move when end play in Carriage is taken out during Add Key depression. See sketch.



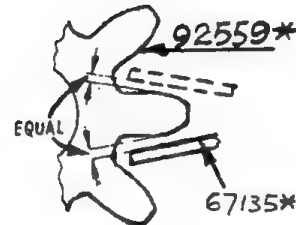
96. CARRIAGE TIMING: a. In both end positions it must be possible to rotate Centralizer farther to position shown. b. Check freeness of Master Clear Link 38680 with #0 Tab Key depressed. See sketch.



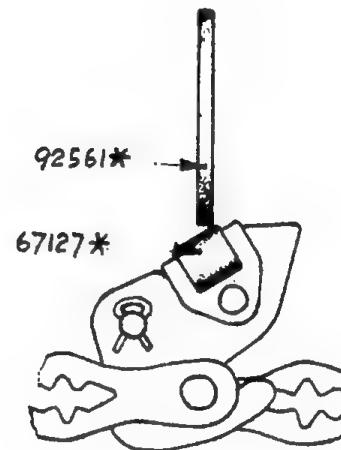
97. COUNTER; CLEARANCE TO DISCS: Must be as shown in all orders. See sketch.



98. COUNTER; THROW: Must be equal for "plus" and "minus" as shown. Check with #1 and #8 Tab Keys depressed. See sketch.



99. COUNTER; ROLLER ENGAGEMENT: Must be 100% at all times. See sketch.



100. COUNTER ACTUATOR must centralize freely; end play of Counter Bail .002-.010.

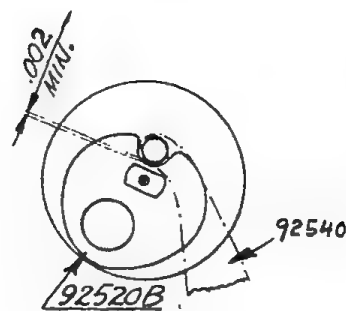
101. CARRIAGE DIP: #5 Tab, all 9's in KB; hold Division Gate back; depress Division Key; depress Dip Rail: Must be just short of grawl.

102. SLIP CLUTCH: Must slip when adding all 9's, must not slip when adding six 9's.

Check with pencil line across Slip Clutch Discs.

103. MD CLEARANCE: All "9"'s in MD must clear by crank, #0 Tab depressed.

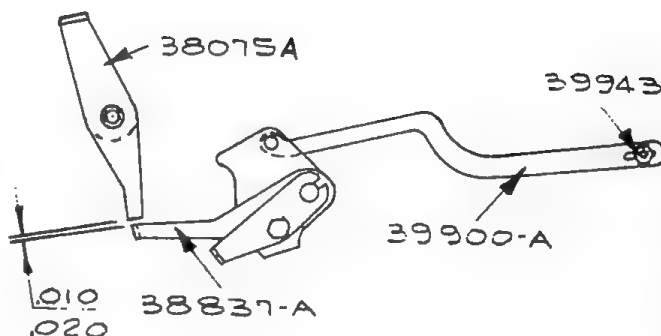
104. UD CLEARANCE: #0 Tab depressed, adjust so that Roller on 92540 in rightmost order is just short of bottoming in 92520-B Disc. See sketch.



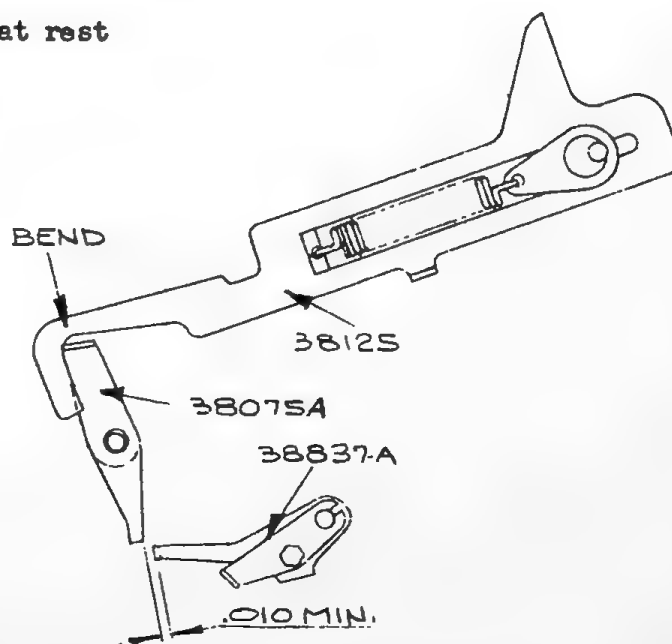
105. 1/2 CENT MECHANISM: Check operation.

106. SPEED: Set to 639 to 651 counts per 30 seconds.

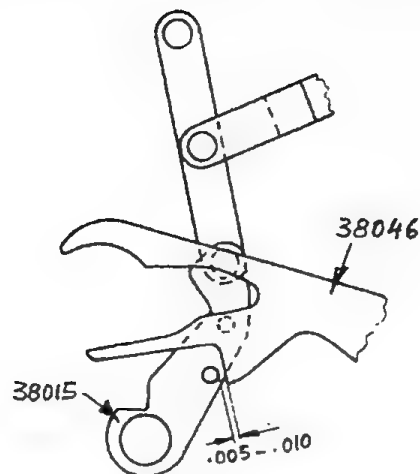
107. SHIFT INTERLOCK BLOCK: Check clearance between 38075A and 38837A with Carriage in dip. (39943 Eccentric). See sketch.



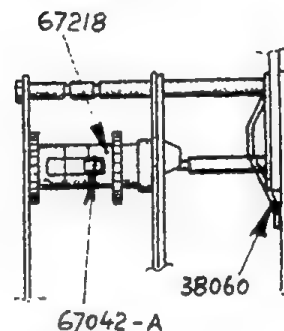
108. INTERLOCK BLOCK: Check clearance at rest position. (Bend 38125). See sketch.



109. COUNTER RETURN LEVER: Clearance to stud on 38015 must be as shown, 38046 must drop freely. (Adjust slot in 38046). See sketch.



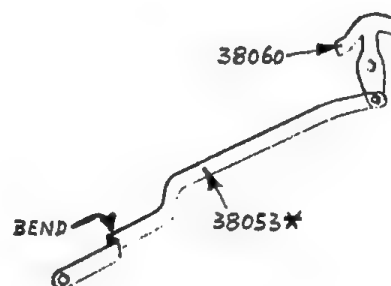
110. COUNTER CONTROL - PLUS: At least 50% engagement of 67042-A with 67218 with Carriage in dip, play taken out. (Bend front arm of 38060 Cam). See sketch.



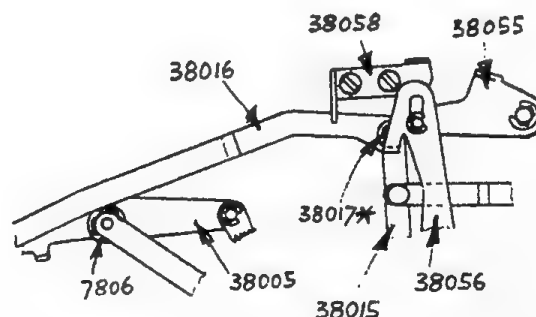
111. COUNTER CONTROL - X-NE: 67042-A must be positioned in the middle of 67212 Split Sleeve during Carriage dip. (Bend form in 38053* to adjust). See sketch.



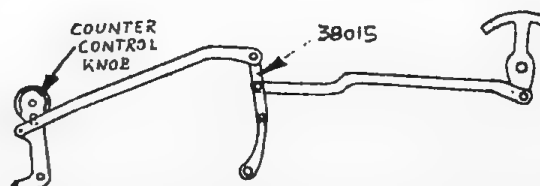
112. COUNTER CONTROL - MINUS: 67042-A must engage right 67218 at least 50% in rest position with play taken out. (Bend rear arm of 38060 Cam). See sketch.



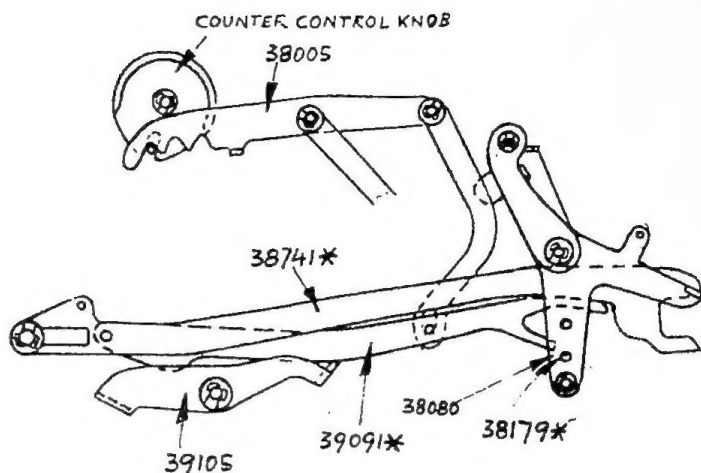
113. REVERSE SETTING BAIL 38055 must be free, engagement of 38017* Stud and ear on 38056 must be satisfactory. See sketch.



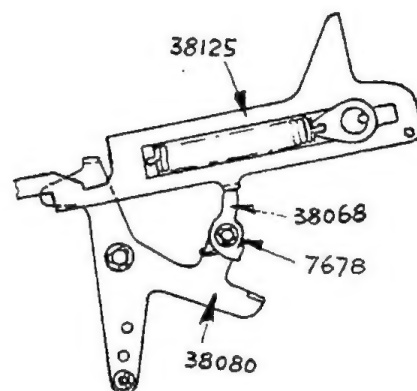
114. COUNTER CONTROL LINKAGE must be free in all Knob positions. See sketch.



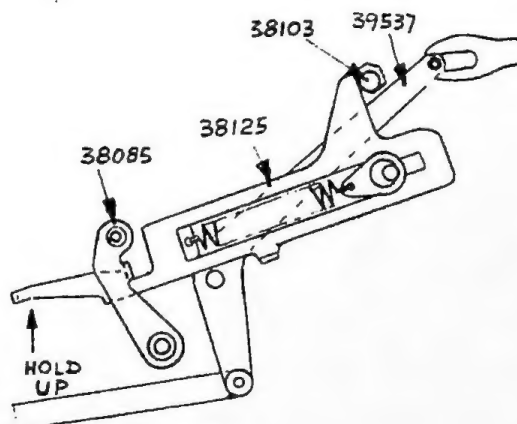
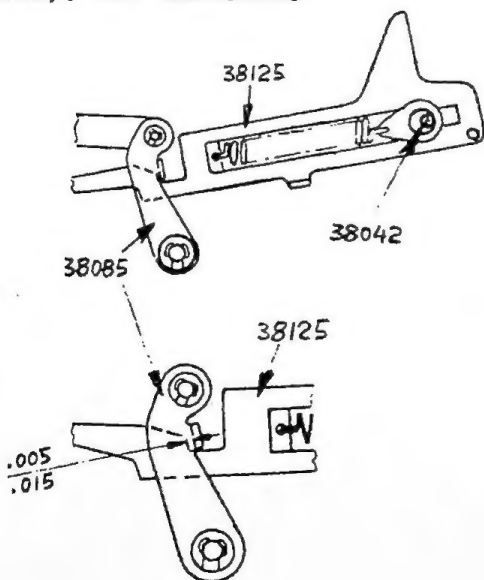
115. COUNTER CLEAR LOCK: Counter Control Knob on "+": 39105 must raise 39091* above stud 38179* on 38080, when UD Lock Key is depressed. Link 38741* must not move when Knob is turned from "+" to "I-NE". (Twist 39105). Check lateral alignment. See sketch.



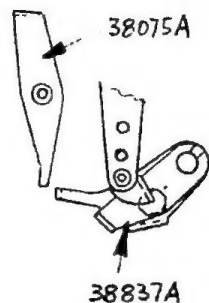
116. ACR - LIVE POINT 38068 must pick up ACR Lever 38125 on last division cycle. (Adjust ear on 38068). See sketch.



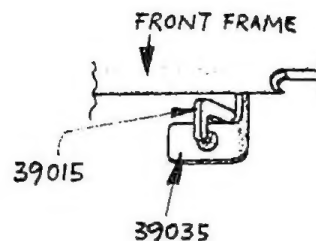
117. ACR - MD CLEARANCE: Step on 38125 must position just behind ear on 38085 by .005 to .015 (Adjust 38042 Eccentric). Hold front end of 38125 until nose contacts 38103: MD Clear Clutch must open. (Rotate 38103 Eccentric). See sketches.



118. ACR - SHIFT INTERLOCK: When clearance is finished release 38125 and check that 38837A rocks up and that Division Pinning is not moved. See sketch.

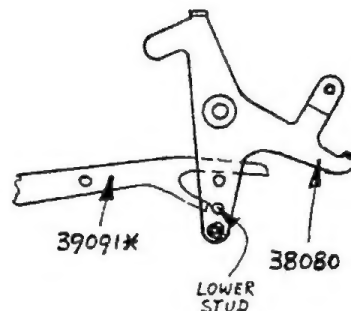


119. ACR - KB CLEARANCE of all 9's must occur at end of Division. (Check 38103 Eccentric, and engagement of Live Point 39015 with 39035). See sketch.



120. ACR - MD LOCK: MD Lock depressed, 38125 must drop.

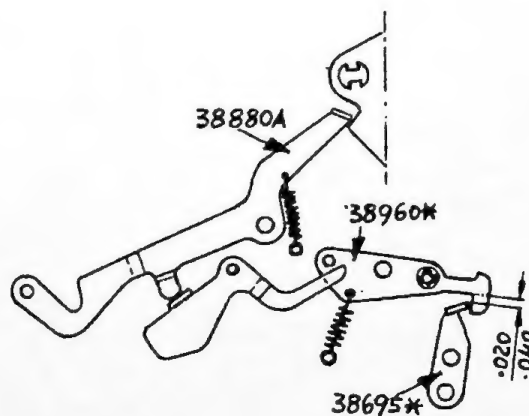
121. ACR - COUNTER CONTROL: Knob must turn from "-" to "X-NE" at end of division; when Knob is turned to "+" 39091* must drop in front of Stud on 38080. Check alignment. See sketch.



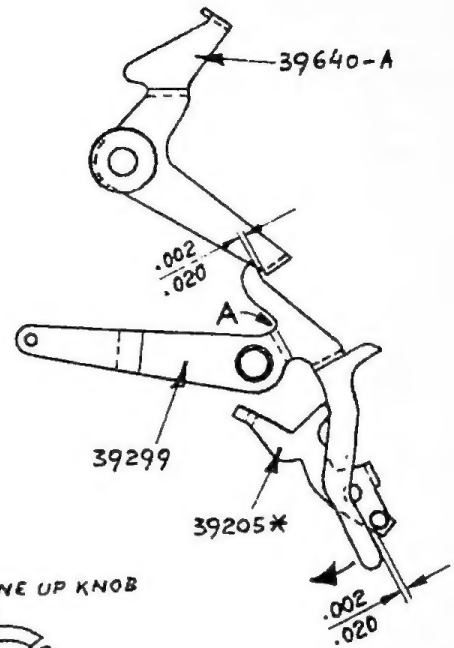
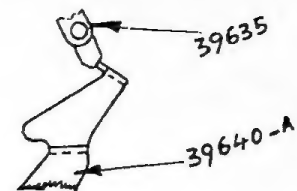
122. STARTING ARM RESTORE: Re-check clearance as shown.

SEE SKETCH WITH PARAGRAPH 9
ON PAGE 2.

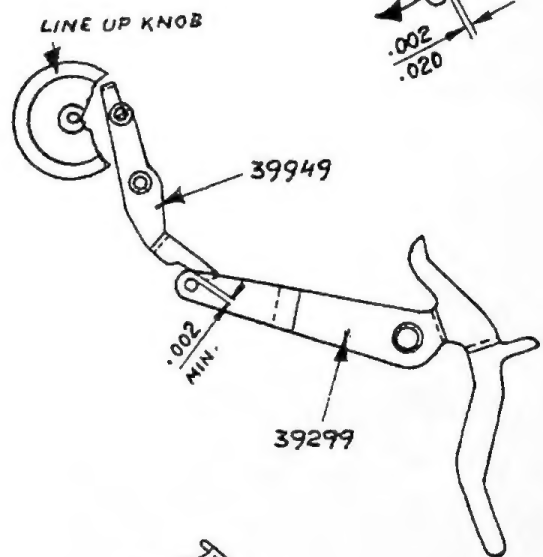
123. LAST POSITION STOP LEVER: #0 Tab depressed, check clearance between Interponent 38960* and Lever 38695*. (Bend 38880A to adjust). See sketch.



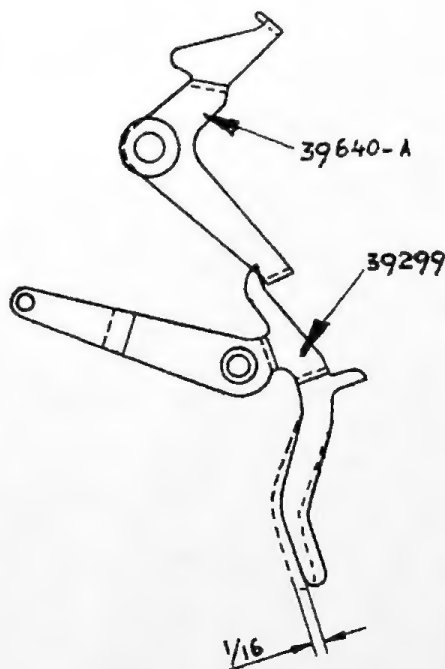
124. L.U. INTERPONENT: Check alignment of 39640-A with 39635 in Carriage (depress #9 Tab Key). Check clearances at upper and lower end of 39299. (Bend at "A" to adjust). Check freeness, alignment. See sketches.



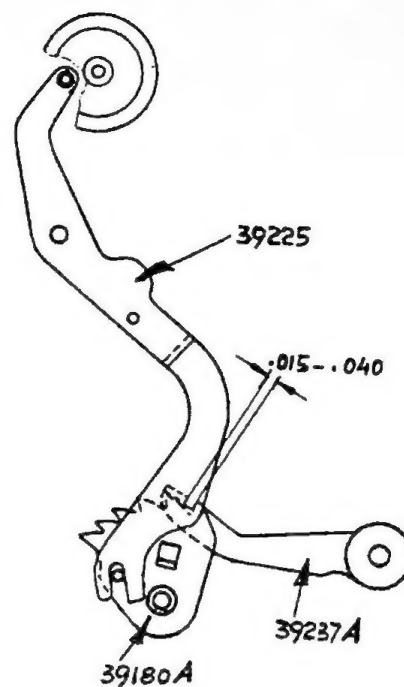
125. ZERO DISABLING: At rest position 39949 and 39299 must have .002 minimum clearance. When Knob is turned between "1" and "arrow", 39299 must move. (Bend 39949). See sketch.



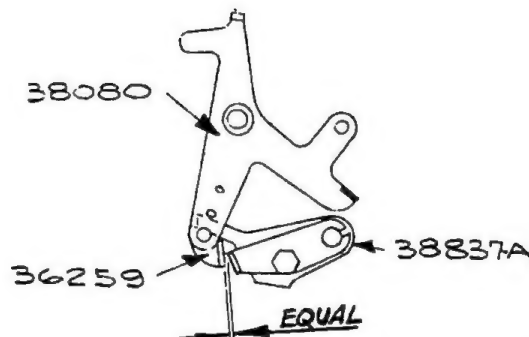
126. END ORDER DISABLING: Alternately depress #8 and #9 Tab Keys and observe movement of 39299 as shown. See sketch.



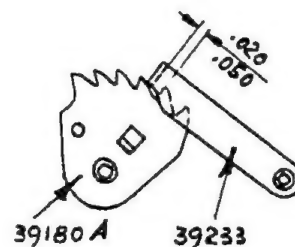
127. COUNT-OUT; HOLDING PAWL: Knob on "arrow"; when Line-up Key is depressed 39237A must drop onto 39180A with clearance indicated. (Band 39225). See sketch.



128. LINE-UP SHIFT INTERLOCK: 38837-A must have equal clearance to adjustable ear 36259 on Division Pinning in both the Line-up shift and the division shift. (Adjust 36259). See sketch.

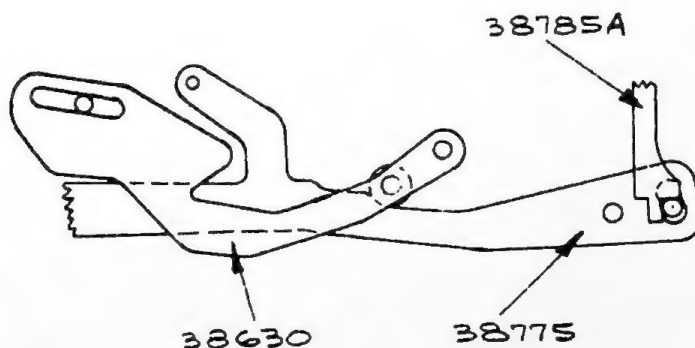


129. COUNT-OUT; DRIVING PAWL: Knob on "5"; during shift 39233 must overstroke Segment 39180A as shown. (Eccentric). See sketch.



130. SHIFT INTERLOCK EAR must block Division Pinning ear firmly during shift. (Twist ear if necessary).

131. SHIFT LATCH must remain bottomed during shift; if not, check whether Pinning goes through too far. See sketch.



132. FUNCTIONAL CHECK: Perform commercial test according to Design Changes

#414 and 435.